SCIENTIFIC AMERICAN

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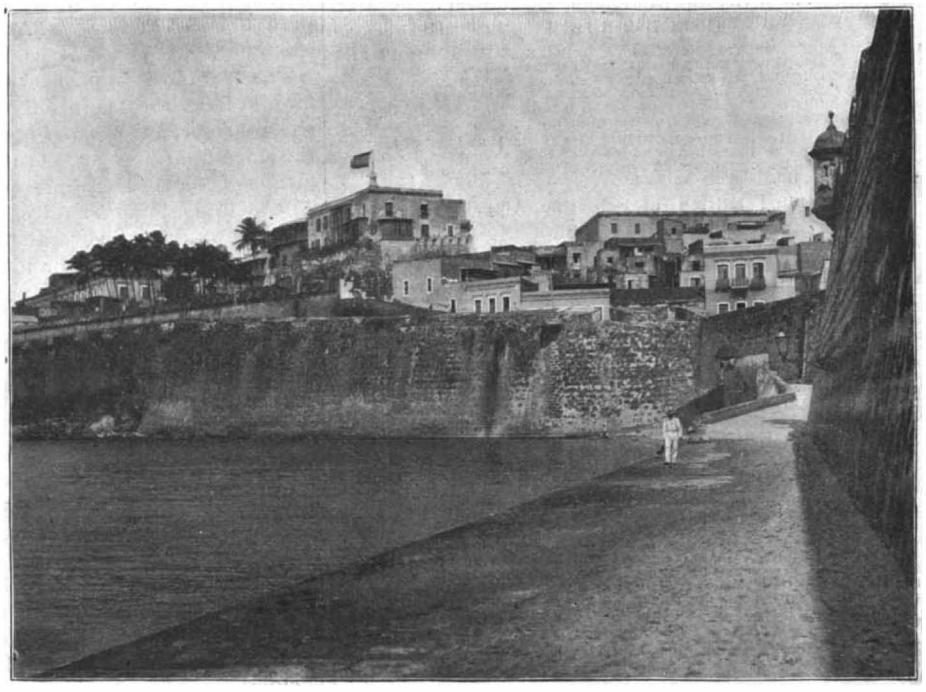
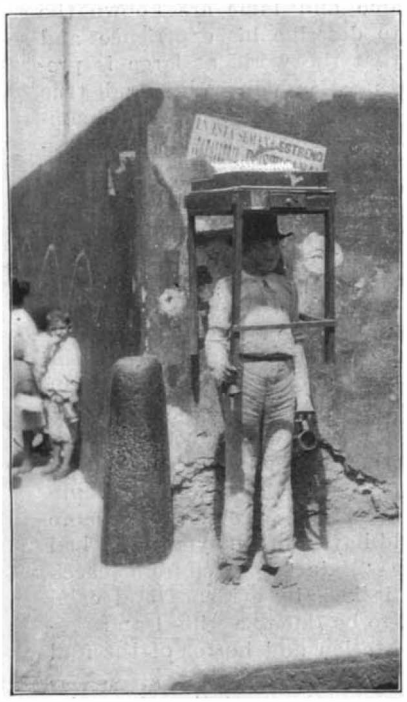
SAN JUAN FROM THE BAY.



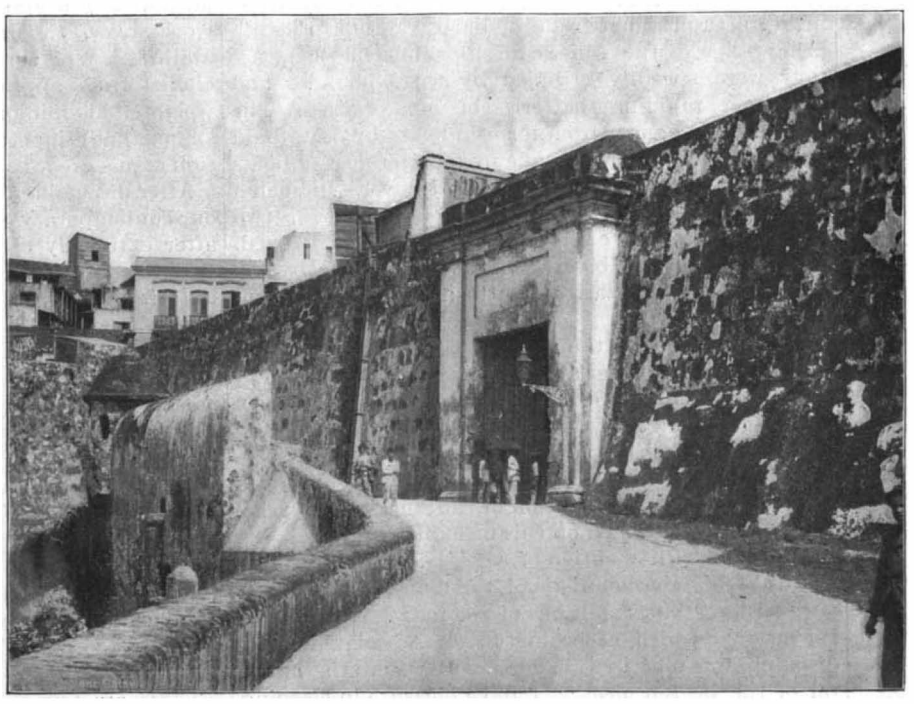
THE OLD CITY WALL.

NATIVE HUT.

SAN JUAN FROM THE INGLATERRA HOTEL.



A PORTABLE CANDY SHOP.



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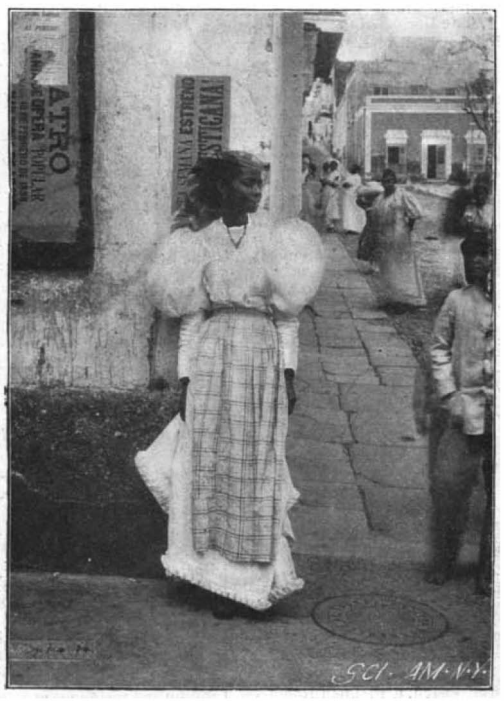

A DUSKY BELLE.

VIEWS ON THE ISLAND OF PORTO RICO.—[See page 326.]

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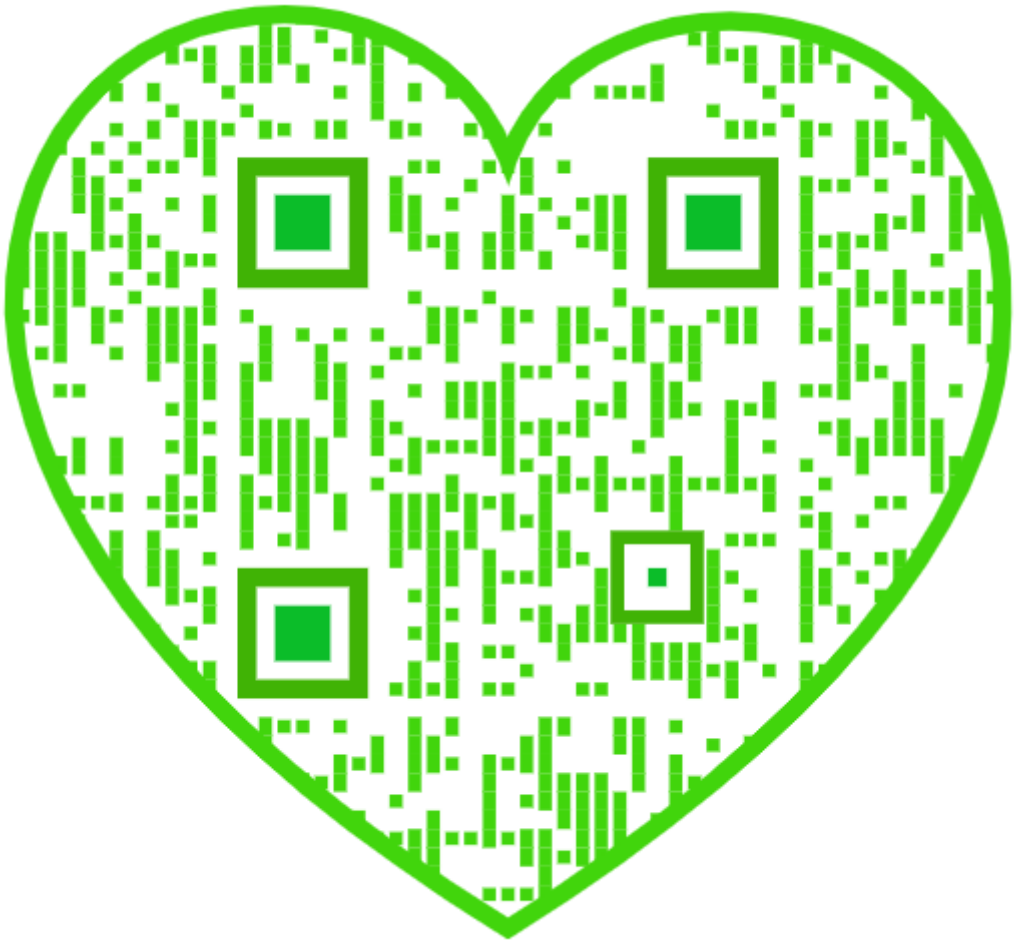

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THE LESSONS OF MANILA BAY.

The brilliant operations of the American fleet in Manila Bay have served to emphasize several well established principles of naval warfare, the truth of which has been recognized through many centuries of struggle for the mastery of the seas. We believe it was Napoleon who said that Providence was on the side of big battalions. That may be true on land, but the history of sea fights without number has taught us that Providence is on the side of forethought, good judgment, discipline, dash, well-timed audacity and above all straight shooting. All of these qualities were conspicuously present in the compact little squadron of half a dozen ships which in the gray dawn of that eventful morning circled around the bay before the astonished gaze of the enemy and at a predetermined hour and on a predetermined plan began to blot the Asiatic fleet of Spain out of existence.

The two most important facts brought out by the Manila fight are the ability of modern ships, even of the unarmored types, to engage land fortifications, and the incomparable value of accurate gunnery as a means of defense against the shell-fire of the enemy. The astonishingly small casualties to our ships and their crews during several hours of fighting is not all to be credited to poor marksmanship on the part of the Spanish gunners. It was largely the result of the rapidity and deadly accuracy of the storm of shells thrown by our vessels, which rendered the gun positions untenable and probably disabled the crews faster than they could be placed at the guns. A crack marksman behind a modern high-powered rifle is worth whole inches of armor protection to the ship on which he serves, and it begins to look as though the theorists might prove to be correct who contend that modern fights will be decided by killing off the gun crews rather than by penetrating belts and demolishing unarmored ends and upper works.

Not less remarkable is the fact that half a dozen unarmored cruisers should have run past shore batteries of considerable strength and blown out of existence a fleet that held a strong position under the guns of a powerful battery. The supreme confidence with which this supposedly impossible feat was undertaken is only equaled by the splendid audacity and cool deliberation with which it was carried out. If the Spanish fleet was taken unawares, it was because its admiral judged—as by all the canons of naval warfare he was justified in doing—that the American fleet of cruisers would never dare to undertake an attack for which only heavily armored battleships are supposed to be available. The success with which the fortifications in Manila Bay were attacked is certain to enhance the value of the swift cruiser as against the more cumbersome battleship. The danger will be that critics will lose sight of the fact that the forts and probably the guns were not of the latest description, and will push too far the lessons that have been taught by the reduction of Cavité arsenal.

The battle has shown again the absolute necessity of removing from a warship every piece of woodwork that can possibly be spared. Our shells loaded with common brown powder served to set fire to the Spanish ships early in the fight, and had the shells been loaded with high explosives, the conflagration would have started sooner and burnt even more fiercely. Fires were started in two of our ships by exploding shells, and, though they were speedily extinguished, they emphasize the necessity for rigidly excluding all unnecessary combustible material from a warship.

The fight again demonstrated the futility of torpedo boat attack when carried out by daylight and in the open. Three separate attempts were made by these little craft to run out from the harbor and dash within firing range of the American ships, but in each case they were speedily crippled by the 6-pounder and 1-pounder rapid-fire batteries of our cruisers. The only possible danger from torpedo boats by day would be when the attack was made by a larger fleet of boats than a ship's rapid-fire guns could cover. In such a case the survivors would probably sink one or two ships of a fleet before they were themselves destroyed. Attacks by isolated boats, such as were made by the Spanish, were necessarily as futile as they were splendidly heroic.

And this suggests the reflection that mere courage and heroism can never atone for the lack of skill and efficiency. Had the Spanish crews been as skilled as they were courageous, our ships and men would never have come so scathless out of the fight. It is to the combination of both qualities in our navy that we must look for an explanation of the amazing disparity in the losses sustained on this memorable day.

We close with mention of a pleasing episode, one that is highly characteristic of the man and in accordance with the best traditions of the navy. We refer to the message which, according to an Associated Press dispatch, was sent by Commodore Dewey to the admiral of the beaten fleet: "I have pleasure in clasping your hand and offering my congratulations on the gallant manner in which you fought." True courage is ever magnanimous; and every acknowledgment of the undoubted bravery of the vanquished is an indirect tribute to the courage and skill of the victor.

FOREIGN EXPERT OPINION ON THE "MAINE" DISASTER.

It is gratifying, though not surprising, to note that the English technical press has given a practically unanimous indorsement of the finding of the Naval Court of Inquiry on the "Maine" disaster. At a time when sentiment or prejudice is dominating men's minds and rendering them incapable of cool judgment, it is to the professional expert that we must look for opinions that count for much. To him the political aspects of such a disaster as happened to the "Maine" are altogether subordinate to its scientific and technical side, and it is safe to say that the findings of our board, as against those of the Spanish commission, would not be indorsed except after an exhaustive and impartial review of the evidence.

The Engineer, of London, says: "The evidence appears to have been taken with great care and with the utmost impartiality. Whether the officers constituting the court had or had not any preconceived notions, we cannot say; if they had, they carefully concealed the fact. Indeed, throughout the whole of the evidence we fail to find expressions of opinion on the part of the witnesses, and the court carefully abstained from putting leading questions. . . . The principal value of this most elaborate and temperate inquiry lies in the lessons that can be drawn from it. It is not possible to read what the divers have to say, or to examine the sketches which they have made, without arriving at the same conclusion as the board."

The other leading technical journal, Engineering, says: "The court was of opinion that this forcing up of the bottom of the ship could only be caused by the explosion of a mine situated beneath the vessel; and at first sight it may appear difficult not to accept this view." It suggests, however, another possible way in which the bottom plating could have been bent into an inverted V, by referring to the fact that after the decks had been blown out the bow sank, while the after half of the ship was still water-borne. This, Engineering suggests, would bend the bottom plating somewhat into the shape in which it was found; but it frankly admits that "it may be objected that this is a somewhat bold flight to account for an upheaval of the keel 34 feet in such a way, and we only advance the hypothesis as possible rather than probable." It concludes by stating that "whatever may have been the primary cause of the terrible catastrophe of February 15, there is one fact that stands out with remarkable prominence. The conduct of the whole ship's company was worthy of the best traditions of the American navy; which is as high praise as could well be given. The suddenness of the catastrophe, far more trying to discipline than the time of battle, the rapidity with which the vessel sank, the continuance of smaller explosions after the great outburst, the darkness of the night, and the fact that many of the crew were asleep, all tended to put the *morale* of the ship's company to as severe a test as could well be imagined; but throughout not a man failed in his duty."

Industries and Iron, London, has devoted two editorials to the subject, the second of which is called forth by the publication in its columns of a letter from a distinguished English engineer indorsing the findings of the "Maine" Court of Inquiry. Speaking of this letter, which we republish on another page, the journal in question says: "Our correspondent in opening his letter remarks that he is 'an old and experienced engineer,' and that he is also 'an expert on explosives.' Thus modestly one of the greatest living authorities, whose name and fame are known the world over, chooses to describe his experience and abilities. We regret that the world at large is precluded from appreciating the high value and true weight of his opinions, owing to the unfortunate circumstance that etiquette and policy require the suppression of his great name."

After discussing the points brought out in the letter, our contemporary concludes as follows: "We believe, after extremely careful consideration of the evidence, that the destruction of the 'Maine' was premeditated, that it was caused from the outside, and that if the Spanish government itself must be acquitted from actual participation in the dastardly deed, then the blame of the crime must be borne by some person or persons not remotely connected with the government. That such a disaster should have occurred at all is dreadful enough, but that it should occur through treachery when the vessel was resting in every confidence under a friendly nation's protection, is more terrible. America would have had our sympathies had the destruction of the 'Maine' proved to be accidental, and now that it has, by evidence and calm judgment, been proved to be due to a willful and premeditated act, our detestation and horror of the foul deed is absolute."

These are fairly representative quotations from the English technical journals, all of which have commented at considerable length upon the disaster, and they indicate the practically unanimous approval of

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our position by that section of the press which is entitled to speak with authority on a question of this special nature.

THE FOUR NEW MONITORS.

The designs for the four new monitors called for by the Naval Appropriation Bill have been determined upon by the Naval Board of Construction. Their displacement will be about 2,500 tons on a draught not to exceed 11 feet. They will be furnished with watertube boilers and twin-screw engines of 3,500 horse power, which will be expected to drive the monitors at 12 knots under natural and 13 knots under forced draught. They are to be furnished with a single turret and a fighting mast. The turret will be carried well forward clear of obstructions. It will be protected by 12 inches of Harveyized steel, and within it will be two of our latest pattern of 10-inch rifles. On a superstructure deck amidships will be placed several 4-inch rapid-fire guns and a numerous battery of 6 and 1-pounders and machine guns. The new monitors will sit low in the water, having a freeboard of only 20 inches, and as the belt armor will consist of 11 inches of Harveyized steel, the new vessels will be very difficult objects for the enemy to hit and disable. The small draught of 11 feet will enable them to navigate shallow channels and shoals in our harbors which would be impassable to the deep draught sea-going craft of the enemy.

It will be seen that the new monitors will be 1,500 tons smaller than the "Terror," "Amphitrite" and "Miantonomoh" and 3,500 tons smaller than the "Puritan." Their speed will be about 2 knots greater than the first named boats and about the same as that of the "Puritan." They will carry only half the number of heavy guns, but their handiness, light draught and powerful secondary batteries and general up-to-date efficiency will render them scarcely less powerful than the ships of the "Terror" class.

ELECTRICAL EXHIBITION.

When we realize the multiplicity of uses to which electricity lends itself, it is little wonder that an exhibition could be inaugurated which would occupy every inch of space in the largest building available for the purpose in New York City.

Among the newer objects shown are the Edison magnetic ore separator, fully described some months since in the SCIENTIFIC AMERICAN. A large working model of this invention shows how the magnetic ore is separated from sand by the action of a magnet. Wireless telegraphy, also described in our columns not long since, is shown in actual operation. There is a large exhibit of Weston's fine testing and measuring instruments, designed for all purposes, including their use in generating stations, institutions of learning, as well as in the laboratories of private individuals. The Walker underground conduit system, lately installed on the Fourth Avenue street railway in this city, is represented by a section of full sized track and a motor car arranged to permit of examination by visitors who are interested to know how this system is operated. The Crocker-Wheeler exhibit includes a 225 horse power dynamo and several other large dynamos and motors; also motor dynamos. A motor especially adapted for use in mills is found here. The exhibit is very creditable, showing improvements in design and finish.

An exhibit showing the extended use of electricity is an emergency wagon, containing tools and materials for electrical repairs of all kinds. The American Electrical and Maintenance Company are represented by this exhibit.

The Electric Storage Battery Company's exhibit is especially noticeable on account of the giant accumulators shown. They are of a type used in Chicago and in the Brooklyn Edison Illuminating Station. One of these cells can give 2,000 amperes for one hour and the other 6,000 amperes for one hour.

The Montauk Multiphase Cable Company have on exhibition their automatic thermostatic protective electric cables. This system gives to wires the power to discover dangerous heat or flame, and automatically to notify at any point or points desired that such heat or flame is in existence, and this upon its inception. The exhibit is attracting much attention on account of its possible application to government use in the present crisis.

The domestic uses of electricity are shown by utensils for cooking according to every conceivable method by heat generated by electricity. The advantages gained by this method are cleanliness, avoidance of unnecessary heat, obviating the necessity of handling coal and ashes, and the saving of room. Another domestic application of electricity is an electrical cradle rocker.

In the generating section are shown two Babcock & Wilcox steel boilers of 265 horse power each, which provide steam for the exhibition. These boilers are furnished with low grade fuel and the fire is urged by a forced draught created by a large fan blower driven by a small engine supplied with steam from the boilers. The steam pressure controls the motion of the engine, the blast being thus varied to suit the requirements. As a consequence, a uniform pressure of steam is maintained and fuel is saved. This system of controlling the pressure by action on the fire by means of a variable forced draught is known as the Beckman system of automatic control. It is exhibited by the Kensington Engine Works, Limited, of Philadelphia.

Several high-speed steam engines driving direct-connected dynamos are shown.

The Woodbury high-speed engine with an Eddy dynamo directly attached is running. It does its work quietly and without apparent effort.

The Onondaga Dynamo Company also have a high-speed engine with one of their own dynamos direct connected. The engine runs smoothly, without a click or a jar.

There is also shown a Fischer engine with a direct-connected dynamo.

The American Engine Company exhibit an American Ball engine direct-connected to a 25 K. W. generator built by the same company.

The Armington & Sims Company exhibit a 13-inch by 12-inch engine direct-connected to a Walker generator, and the New York safety steam engine is shown connected directly with a dynamo constructed according to the Wood system by the Fort Wayne Electric Company. These engines and dynamos show to what perfection the apparatus for the generation of electricity has arrived.

The Hornsby-Akroyd safety oil engines are exhibited. These engines are operated by the vapor of kerosene oil, the oil vapor being ignited without the use of hot tubes, flames or electric sparks, as usual in gas engines.

The National Meter Company have on exhibition a 70 horse power gas engine connected direct to a generator. It does its work without trouble and is a compact and desirable form of motor.

The Diesel motor is the more recent of gas engines. It operates on a new principle. It follows the lines of a vertical marine engine and is connected directly with a dynamo. The motor cylinder is placed on a stout A-frame, in the rear leg of which a small air pump is secured. The action is on the 4-stroke or Otto cycle. It differs from all previous internal combustion engines in compressing a full charge of air to a point above the igniting point of the fuel, whether liquid or gaseous, then injecting the fuel for a certain period (variable according to load) into the red hot air, where it burns with pressure and temperature under control. There are no explosions, as in other gas or oil engines, but steady combustion at much lower temperature and without essential increase in pressure, the combustion line being practically isothermal. It is claimed that fully 28 per cent of the value of the fuel is utilized. This motor was fully described in a recent issue of this journal.

CALCIUM CARBIDE AS AN AID TO FIRE.

In the SCIENTIFIC AMERICAN for May 7 we referred to a fire caused by water coming in contact with calcium carbide. We are informed by the Creig-Reynolds Foundry Company, of Dayton, Ohio, we were in error in reporting the fire at their works as a carbide fire. The fire started in the extreme end of their warehouse building, some hundred or more feet from the carbide, and when the flames reached the carbide cans the solder was rapidly melted and the carbide, being surrounded by water, generated gas immediately, which was communicated to the flames and, consequently, made a great blaze; but, out of some 8 or 10 tons of carbide on hand, they lost less than 1,500 pounds. In no way can the fire be attributed to the storage of the carbide, and it was not to blame in any way for the origin of the fire; but the very fact that the carbide assisted the conflagration shows that the regulations regarding the storing of carbide in quantities in some cities have not been made in vain.

UNITED STATES ARMY RECRUITING CIRCULAR.

WAR DEPARTMENT, ADJUTANT-GENERAL'S OFFICE,
WASHINGTON, April 27, 1898.

The following instructions will govern recruiting for the regular army in time of war:

Applicants for enlistment must be between the ages of 18 and 35 years, of good character and habits, able-bodied, free from disease, and must be able to speak the English language. Married men will be enlisted only upon the approval of a regimental commander. Minors must not be enlisted without the written consent of father, only surviving parent, or legally appointed guardian. Boys between the ages of 16 and 18, who may be needed as musicians, may be enlisted as such, with the approval of the proper commanding officer. Original enlistments will be confined to persons who are citizens of the United States, or who have made legal declaration of their intention to become citizens thereof. Applicants will be required to satisfy the recruiting officer regarding age and character, and should be prepared to furnish the necessary evidence.

For infantry and artillery the height must be not less than five feet four inches, and weight not less than one hundred and twenty pounds and not more than one hundred and ninety pounds.

For cavalry the height must be not less than five feet four inches and not more than five feet ten inches, and weight not to exceed one hundred and sixty-five pounds. No minimum weight is prescribed for cavalry, but the chest measures must be satisfactory.

Table of Physical Proportions for Height, Weight, and Chest Measurement.

HEIGHT.		WEIGHT.	CHEST MEASUREMENT.	
Feet.	Inches.	Pounds.	At expiration: Inches.	Mobility: Inches.
5	4	128	32	2
5	5	130	32	2
5	6	132	32½	2
5	7	134	33	2
5	8	141	33¼	2½
5	9	148	33½	2½
5	10	155	34	2½
5	11	162	34¼	2½
6	72	169	34¾	3
6	1	176	35¼	3

It is not necessary that an applicant should conform exactly to the figures indicated in the table of proportions, the variation of a few pounds in weight either way, and of a fraction of an inch in chest measures, being permissible.

Applicants must defray their own expenses to the place of enlistment. Their fitness for the military service can be determined only upon examination at a military post or other recruiting station.

The term of service is three years.

All soldiers receive from the government (in addition to their pay) rations, clothing, bedding, medicines, and medical attendance.

The following are the rates of pay as fixed by law:

Grade.	Pay per month.	Pay per year.	Pay for 3 years.
COMPANY.			
Privates—Cavalry, Artillery, and Infantry	$13	$156	$468
Field Musicians—Cavalry, Artillery, and Infantry	13	156	468
Wagoners—Cavalry, Artillery, and Infantry	14	168	504
Artificers—Artillery and Infantry	15	180	540
Saddlers—Cavalry and Light Artillery	15	180	540
Farriers and Blacksmiths—Cavalry and Light Artillery	15	180	540
Corporals—Cavalry, Artillery, and Infantry	15	180	540
Sergeants—Cavalry, Artillery, and Infantry	18	216	648
Quartermaster Sergeants—Cavalry and Light Artillery	18	216	648
Veterinary Sergeants—Light Artillery	18	216	648
First Sergeants—Cavalry, Artillery, and Infantry	25	300	900
REGIMENT.			
Quartermaster Sergeant—Cavalry, Artillery, and Infantry	23	276	828
Sergeant-Major—Cavalry, Artillery, and Infantry	23	276	828
Saddler Sergeant—Cavalry	22	264	792
Chief Trumpeter of Cavalry	22	264	792
Principal Musician—Artillery and Infantry	22	264	792

To the rates of pay enumerated above 20 percentum will be added in time of war.

In addition one dollar per month for the third year of enlistment will be paid to the soldier. Soldiers reenlisting within three months from date of discharge receive a further increase of pay for the fourth and fifth years of service, and a still further increase for each five years of continuous service.

The soldier can deposit his savings in sums not less than $5 with any army paymaster, and for sums so deposited for the period of six months or longer, the soldier, on his final discharge, will be paid interest at the rate of four per cent per annum. These deposits are nonforfeitable except for desertion.

Whenever a soldier is honorably discharged at the expiration of his enlistment, or on account of disability not caused by his own misconduct, his travel pay is ample to carry him to the place of enlistment.

By care and economy, a soldier can save from his clothing allowance a considerable sum, payable to him on his discharge.

For soldiers who have served honestly and faithfully twenty years, or who have been discharged for wounds received or disease incurred in service, a comfortable home is maintained in the city of Washington. The sum of 12½ cents per month is deducted from each soldier's pay, to be applied toward the support of the home. After thirty years' service enlisted men are entitled to be retired, and upon retirement receive three-fourths of the monthly pay allowed by law to them in the grade they held when retired, and $9.50 per month as commutation for clothing and subsistence.

By order of the Secretary of War.
H. C. CORBIN, Adjutant-General.

PROF. RAY LANKESTER, in a recent lecture in England, gave a clear and easily understood explanation of how inoculations of mild disease will cure or prevent the severer kinds. Protoplasm, he said, had the capacity for being taught to tolerate a chemical action from which it naturally shrank. A mass of protoplasm attracted in the direction of a solution of sulphate of iron would at first grow down to the edge of it and then draw back, but in a little time would plunge boldly through and across it, and this protoplasm thenceforth would have no fear of sulphate of iron. The amœboid corpuscles of the blood are attracted by what is called "chemotaxis" to the germs of disease entering the body, and swallow them up; but these bacteria in their turn produce a poison which repels the corpuscles. The latter, however, can be taught by gradually increasing doses to tolerate the poison, and in this way the body can acquire an immunity against even the full strength of the disease.

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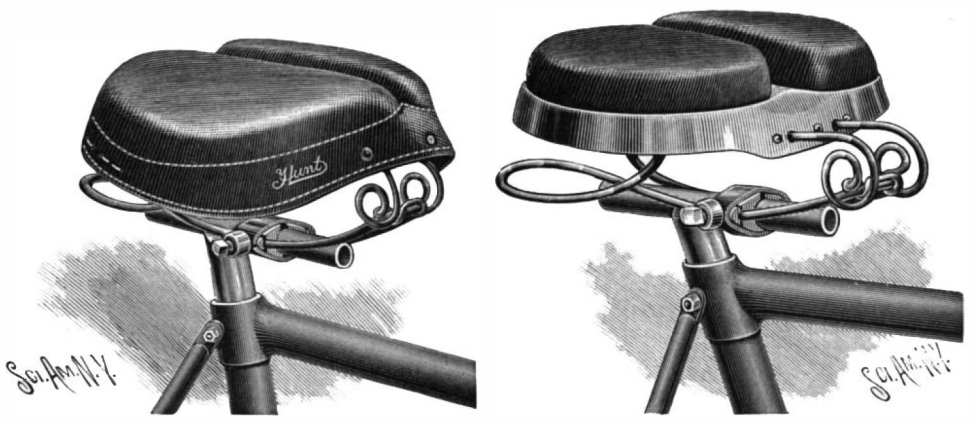
THE NEW HUNT BICYCLE SADDLES.

The subject of bicycle saddles is an important one, as upon it depends not only the safety but, to a large degree, the comfort of the rider. Nothing tends to make the cyclist more tired than a saddle which is ill adjusted and ill fitted. A few years ago the bicycle saddle was the last thing thought of, but at length the ingenuity of the manufacturers resulted in the production of saddles based on anatomical principles, and their attention was then devoted to the elaboration of the details which make the saddles of to-day so convenient and comfortable. Among saddles, the "Hunt" saddle, made by the Hunt Manufacturing Company, of Westboro, Mass., has an enviable reputation. Our engravings represent two of the many types of saddles which this company have now ready for the bicycle trade. Our first illustration shows a saddle known as style X–50, which is especially intended for a large class of riders who are looking for a saddle that is entirely without a pommel. This is a padded pattern with leather strand supports. The weight of the saddle is 26 ounces; the length is 7½ inches; the width is 9 inches. The padded saddles of this company differ from those of other saddle makers in that, instead of being supported by a rigid base, there is the same laced framework found in their hygienic saddles, which enjoy a well deserved reputation, so that in their padded saddles the framework yields as well as the pad under the rider's weight, and there is no liability of the pads becoming hardened by constant pressure of the rider's body, as is inevitable with a rigid support.

Our second illustration shows what is known as the "Sovereign" saddle. It is specially intended for the class of riders who desire a saddle having no pommel and yet require some assistance from the saddle in balancing the wheel. To meet this requirement, the "Sovereign," which is otherwise known as the "Semi-pommelless" saddle, has been devised. It is provided with two pads of generous thickness and well separated for anatomical reasons. The spring underneath aids the curled hair of the pads in giving a cushioned effect, and its riding qualities are excellent. It also presents a fine appearance, as the metal parts are all finely nickel plated, giving it a high finish. The ordinary form of the elongated pad at the front causes great discomfort, because the points of the pad are hard and unyielding, partly because of the shape and partly because there is no spring in front. In the "Sovereign" the makers have hit upon a happy combination of spring and pad, which will unquestionably solve many of the difficulties experienced in riding padded saddles. The outline of the pad is slightly triangular, with well rounded corners, so that the front of the pad, instead of projecting forward and forming a ridge, slopes gently toward the center, causing no obstruction to the movement of the rider's limbs. This feature removes the physician's final objection to padded saddles, so there is little wonder that this type of saddle has consequently received the unqualified indorsement of the medical fraternity. Our engraving shows the sensitive coiled spring in front, which accomplishes two objects: It affords instant relief to the rider from sudden jolts and at the same time is adequate for balancing the wheel. Thus a saddle is obtained with ample spring at the rear, doing away with the objection to a pommel or elongated pads, and yet furnishing an opportunity to easily balance the wheel. The improvement in their S spring for 1898 is shown in the forward coil, where the bolt and nut formerly used have been superseded by a change in the form of both springs, so that the coil is self-secured. This spring is furnished on no less than twenty-two different patterns made by this company. Another interesting feature of this saddle is the clever post clamp, which is operated by a single screw and which is absolutely positive and very simple. It brings the saddle close down upon the frame, which is a very desirable feature.



NEW TYPES OF BICYCLE SADDLES.

A MEXICAN STATUE OF TERRA COTTA.

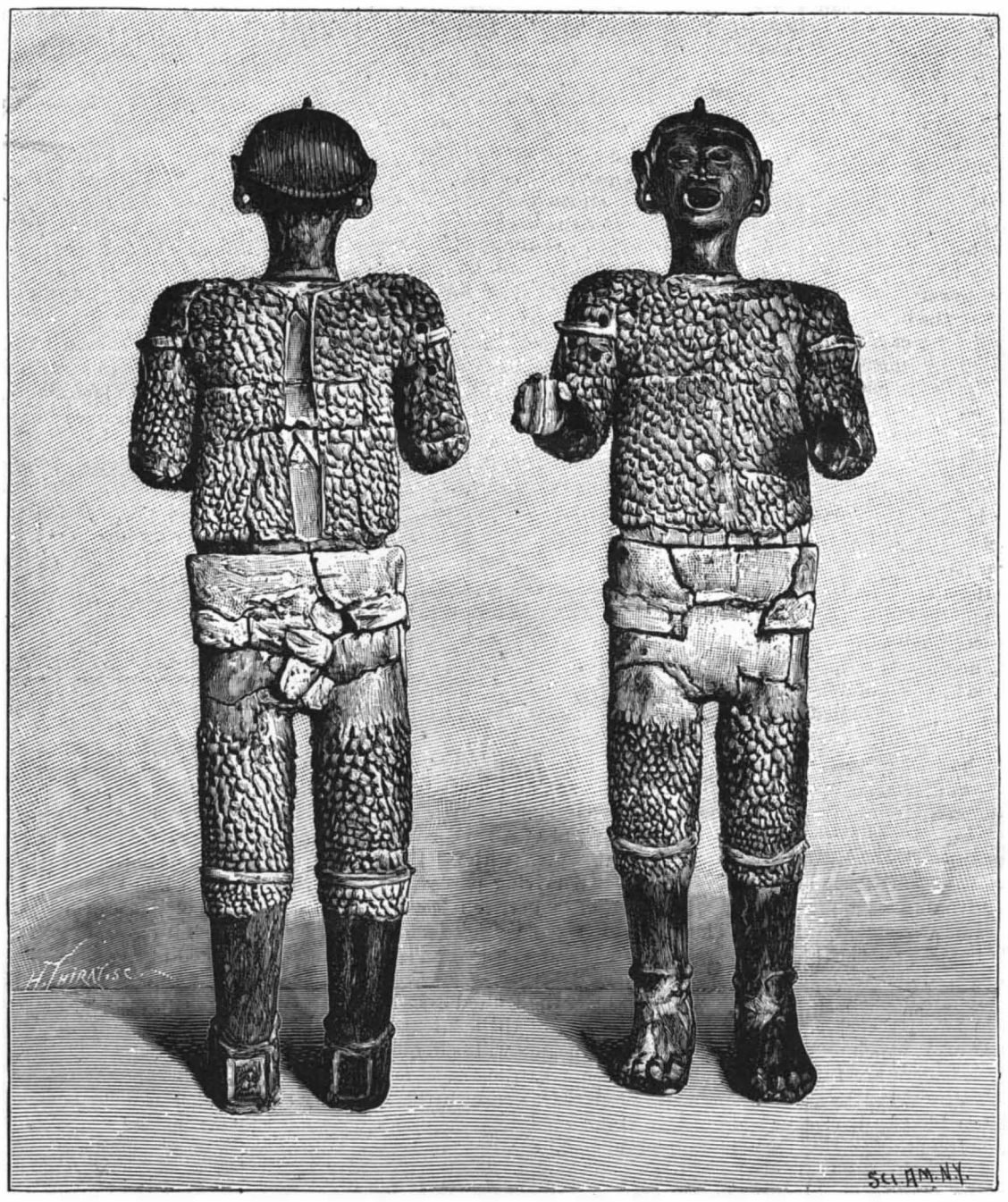
No one would suppose that the ancient Mexican civilization was far enough advanced to produce statues of terra cotta of natural size; and yet one has recently been found by an Indian in digging in a cavern near the city of Tezcoco. This statue, which is probably that of a warrior, is 5¼ feet in height and 18 inches in width between the shoulders. The mouth is wide open, as if the individual were in the act of singing or shouting. The hands must have held some such object as a weapon or musical instrument, but, since the fingers are broken off, all conjectures as to this are rendered impossible. The statue was made in three different sections. The head, which is in a single piece, was attached to the trunk by a tube. The second section comprises the central part of the body, and the third the legs. These sections were evidently moulded separately, but no trace of the moulds that were used has been found. The naked parts were painted dark red. Their polish recalls that of the vases that are found in the valley of Mexico. The clothing, on the contrary, bears no trace of color, except at the points where they have been blackened by smoke in the process of baking. This clothing consists of a blouse ("uipilli") with very short sleeves, attached at the back. Around the loins are distinguished the remains of a cotton girdle ("maxlatl"). The legs are covered with long leggings extending below the knee. The footgear consists of sandals held in place by two straps, one of which passes between the first and second toes and the other between the third and fourth.

The head exhibits the curious artificial flattening of the frontal and occipital bones so frequent in Central America, and which some Indian tribes still practice in our day.

The ears are pierced, but the rings, which were probably of copper, have disappeared. The same is the case with the pendant that was attached to the nose, and which was an ornament worn exclusively by chiefs and warriors. The hypothesis that the statue was that of a chief or warrior is strengthened by the cotton armor, which Torquemada describes under the name of "ichcauhuitl." This offered so efficacious a protection, says this writer, that the Spaniards hastened to adopt it in order to protect themselves against the arrows and the formidable saber ("maquahuitl") of the Mexicans. This weapon consisted of a strip of wood in which were inserted numerous fragments of obsidian, and which the Mexicans used with great dexterity.

The arrangement of the hair is such as to give the idea of a wig. There are apertures in the arms, shoulders and breast for closing the cracks.

Although the origin of this terra cotta statue is unknown, it is certain that it antedates the Spanish conquest. For the illustrations and the above details we are indebted to La Nature.



A MEXICAN TERRA COTTA STATUE.

For Facilitating Examination of Inventions.

The Cycle Age voices the sentiments the SCIENTIFIC AMERICAN has presented, as being of the greatest importance to inventors. Factory superintendents and inventors, says the editor, will be interested to learn that the Platt bill for revising and perfecting the classification of letters patent and printed publications in the Patent Office has been reported favorably from the Senate committee on patents, and there is every prospect that it will speedily become a law. Our patent system proceeds upon the idea that when an application for a patent is made, it is to be determined in the Patent Office, before letters patent are issued, that the invention is new and useful and made by the applicant. This involves an examination of every application for a patent and seach in the whole field of domestic and foreign patents already granted, and in all published technical works to discover whether the invention has been anticipated. In other words, whether, in the language of the constitution, it is "new and useful." The wonderful increase of inventions, of patents at home and abroad, has greatly enlarged the field of search, and yet, if a patent is to be what under our law it purports to be, of real value to the inventor and prima facie evidence of title to his invention, the search and examination must be thorough and complete. The increase in the field of search is enormous. Each year, since 1883, more than 20,000 patents have been issued by the United States. Last year the number was 23,794. The number of foreign patents issued each year is something over 60,000. The pressing need now is for a more perfect arrangement of the patents and applications and references of all kinds in the Patent Office. When it is remembered that the expenses of the Patent Office are not only paid by inventors, but that a surplus is each year turned into the treasury of the United States, forming a special, idle fund of over five million dollars, it would seem that there could be no question of the duty of Congress to provide sufficient force for the prompt transaction of the business.

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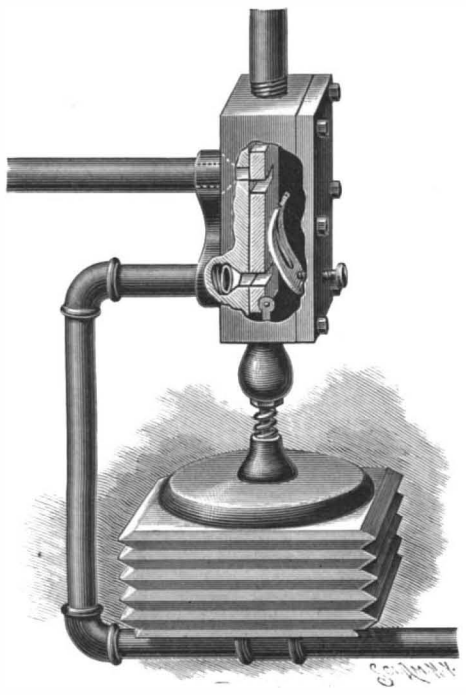
A NOVEL FLUID PRESSURE REGULATOR.

The improved fluid pressure regulator represented by our engraving and recently patented by Jenkin Williams and Joseph R. Rees, of Pueblo, Col., is provided with a chest connected at its top by a pipe with a main for leading gas, steam or other fluid into the chest. In the chest is formed a valve seat from which two ports lead to a service pipe and an escape pipe respectively. On the valve seat a slidable valve is mounted,



WILLIAMS' AND REES' FLUID PRESSURE REGULATOR.

pressed tightly against the seat by a spring, the tension of which may be regulated by a screw. The valve is provided with two ports so arranged that when the lower port is in register with the service pipe, the upper port is disconnected with the escape pipe, and vice versa. The service pipe has an upwardly extending branch, opening into a bellows, which in turn press against a rod surrounded by an expansive spring and extending through a stuffing box into the chest, there to connect with the sliding valve. When the fluid enters the chest, it passes through the service pipe, thence to be distributed to the devices on which it is to be used. The fluid also passes through the branch pipe into the bellows, expanding them so as to hold the valve in the open position shown in our cut. When the pressure in the main increases abnormally, then the pressure in the service pipe causes the bellows to expand still further, thus moving the valve upward, cutting off the fluid from the service pipe and bringing the port of the escape pipe into register with its valve port. A sufficient quantity of gas having by this means escaped, the bellows collapse correspondingly, the valve slides down, thereby closing the escape pipe port and opening the service pipe again. Should the service pipe break, the bellows collapse completely, the valve descends and the fluid is cut off from the service pipe, thus preventing its waste. An effective arrangement is therefore provided for automatically shutting off the supply of gas or water to a building in case of fire.

AN AUTOMATIC ACETYLENE GAS GENERATOR.

Artificial illumination produced by means of acetylene gas is found to possess more of the qualities of daylight than other artificial lights, not excepting even arc light. The recent invention of the electric method of making calcium carbide permits of the production of acetylene gas by a very simple process at a cost which allows of its general application.

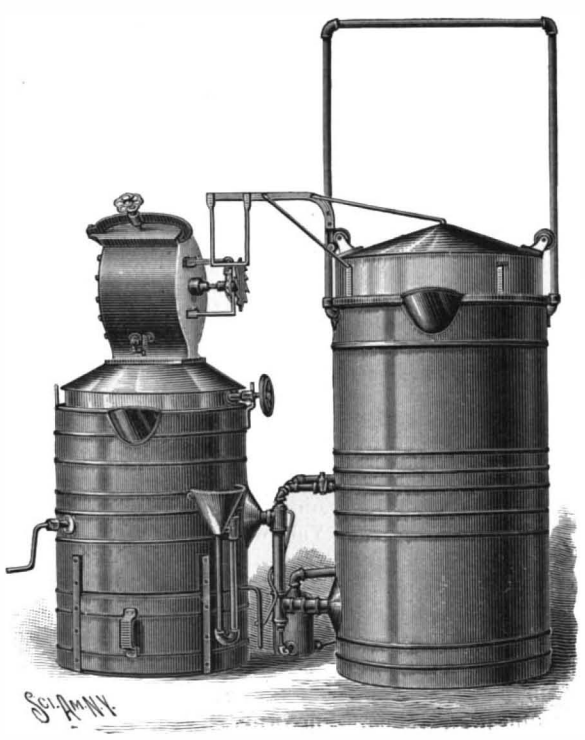
The important feature in the use of acetylene is to secure a simple generator for making the gas continuously with safety and economy.

Our engravings represent an acetylene gas generator of this description. It is known as the "Ordway," and is manufactured by the National Acetylene Gas Generator Company, of Corning, N. Y., and St. Paul, Minnesota.

The apparatus consists primarily of an automatic feed generator and a gasometer. The automatic feed device, which is placed above the water tank, has a casing containing a magazine, which is cylindrical in form and divided into ten or more radiating compartments. The compartments are filled with calcium carbide from the top of the inclosing case, each compartment being then closed by a hinged and latched cover. A trip placed on the side of the inclosing case engages each latch as it passes by, and causes the cover of the compartment to open. The calcium carbide drops into the water below, where it is decomposed without heating the apparatus, the heat being absorbed by the water. This gas bubbles through the water, rises to the top of the generator and passes through pipes to the adjacent receiver, where it is again discharged into water, removing the impurities. The gas fills the gasometer, causing it to rise, and is then conducted from the gasometer by a distributing pipe. By this method a fixed quantity of gas is generated each time, and the gasometer is designed with ample capacity to hold this; there is consequently no over-production or waste. The escape or safety pipe is arranged within the gasometer by means of telescoping tubes, forming a water seal.

As the gasometer discharges its gas it slowly descends, and when near the end of its downward course, a pawl carried by an outwardly extending arm engages a ratchet wheel on the shaft of the magazine. The weight of the gasometer acting upon this wheel causes the magazine to rotate, thus closing the empty compartment and bringing the latch of the next compartment cover into contact with the trip, thereby opening the cover and causing the contents of the compartment to fall into the water below. A locking device prevents the feed cylinder from rotating through more than one space at a time, and a detent prevents the backward rotation of the cylinder. The action of this feed mechanism is consequently automatic.

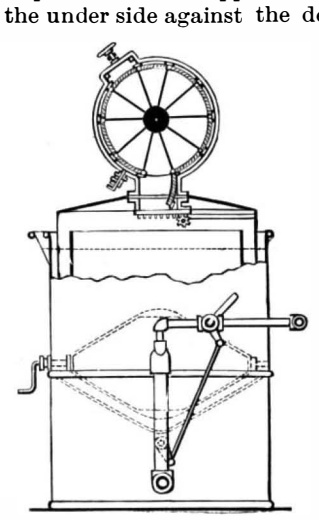
In the lower portion of the generator an agitator mounted upon a shaft is turned by a crank outside the tank. By it the residuum may be loosened from the bottom of the tank and drawn off by a cock connected by rods with the valve of the distributing pipe of the gasometer. By turning a lever the cock and the valve of the distributing pipe are opened simultaneously, thereby equalizing the gas pressure and preventing siphoning. The large gate valve shown at the base of the cylinder is closed when the machine is recharged, thereby cutting off the gas and preventing any escape into the room. A dial register is provided, by which it may be seen at a glance how much carbide there is in the generator at any time.



AN AUTOMATIC ACETYLENE GAS GENERATOR.

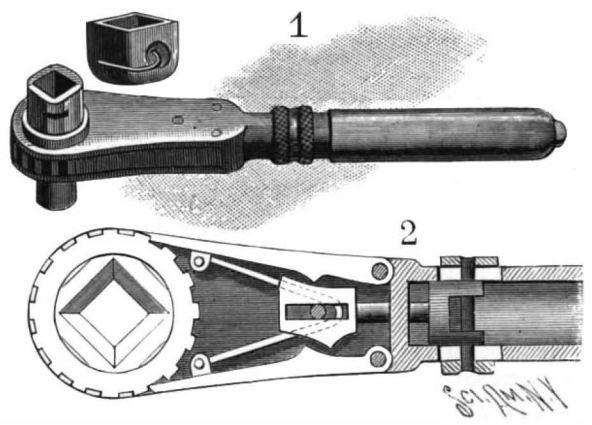
Sleep of Plants.

In a large number of plants examined, Herr E. Stahl finds that the nocturnal position of the leaf or leaflets acts as a protection against the deposition of dew, and thus promotes transpiration and increases the amount of nutriment conveyed to the assimilating organs by the ascent of water in the stem. He regards this as its main function rather than, as has been alleged, the prevention of excessive radiation. The nocturnal position of the leaf or leaflets may be classed under two heads: (1) They are directed downward, so that the under side is better protected than the upper side against the deposition of dew (Biophytum sensitivum, Oxalis acetosella, Robinia pseudacacia, Hedysarum gyrans, Impatiens noli-me-tangere, etc.) (2) They are so placed that the upper side is better protected than the under side against the deposition of dew (Colutea arborescens, Trifolium repens, Impatiens glandulifera, etc.) This difference is usually correlated with a difference in the disposition of the stomates on the two surfaces, as is well seen in the two species of Impatiens named; but there are exceptions to this rule. Geotropism probably also plays some part in producing the vertical nocturnal (nyctitropic) position of leaves and leaflets.—Bot. Zeitung, 1897, 1te. Abtheil., p. 71.



A REVERSIBLE RATCHET WRENCH.

In the improved reversible ratchet wrench shown in our cut, the wrench-socket on which the ratchet wheel is formed or secured is mounted to turn in a casing provided with two plates formed at their rear ends with semi-cylindrical extensions on which a handle screws for holding the parts of the casing securely in position. Referring to the sectional view, it will be seen that fulcrumed, spring-pressed pawls pivoted in the casing



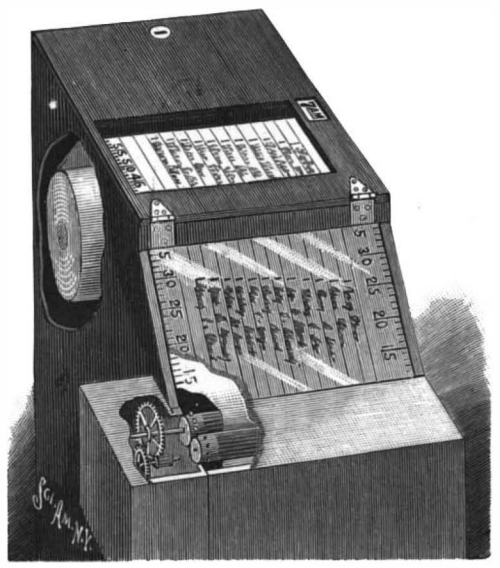
TYLER'S REVERSIBLE RATCHET WRENCH.

engage the ratchet wheel at opposite sides, the pawls being provided with inclines which may be engaged by the cam faces of a longitudinally moving cam block. By this arrangement either pawl may be thrown in mesh or out of mesh with the ratchet wheel. The cam-block is provided with a stem extending rearwardly through a clamp provided with lugs projecting over part of the semi cylindrical extensions, the stem being formed with a head fitted to slide into the same extensions. This head is engaged by a cross-pin passing through slots in the handle casing, to connect with a ring or collar fitted to slide on the semi-cylindrical extensions.

In using the wrench, the ring is pushed forward or rearward, bringing either pawl into operative position as desired and according to the direction in which the workman wishes to use the wrench. An auxiliary socket carrying a spring for engagement with a recess on the wrench-socket enables the wrench to be used for large objects. The invention has been patented by Elias M. Tyler, of Emigrant Gap, Cal.

AN IMPROVED TIME RECORDER.

The time recorder illustrated in our engraving, and recently patented by Frederick W. Cook, of San Antonio, Texas, embodies features which are a de-



COOK'S TIME RECORDER.

parture from previous devices of this character. The operative mechanism in Mr. Cook's contrivance consists of clock-driven rollers which act directly upon a roll of paper mounted in the casing. The paper is lined longitudinally and is graduated along its edges to represent hours and minutes. The clock-rollers draw the paper over a table at a wide opening in the casing, so as to enable employes to write their names upon the longitudinal lines. A slot in the lid on the left hand side of the opening partially exposes the graduated edge of the paper and enables the employe to see at what time he writes his name. A transfer strip is secured to the under side of the lid and extends transversely into the opening and in a line with the slot. When an employé writes his name, he makes a mark upon the strip which transfers the impression in different colored indelible substance to the paper beneath and indicates the exact time when the name was written. Instead of exposing a single space to accommodate one name written transversely, as in the ordinary time recorders, the apparatus, it will be seen, provides for a number of lines upon which several names may be written longitudinally at approximately the same time. The clock mechanism, by acting di-

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rectly on the rollers, dispenses with all auxiliary devices. The apparatus is designed for use in large stores, offices, factories and the like, and is also adapted to record the rounds of a night watchman.

PORTO RICO AND THE REDUCTION OF SAN JUAN.

Last week it was our pleasing duty to chronicle the decisive victory of Manila Bay, we are now able to announce that the reduction of San Juan, the fortified capital of Porto Rico, by Admiral Sampson was attended by few casualties and no injury to the fleet. The squadron, consisting of the flagship "Iowa," the "Indiana," "New York," "Terror," "Amphitrite," "Detroit," "Montgomery" and the "Porter," in search of the Spanish fleet, arrived at San Juan, Porto Rico, at five o'clock in the morning, May 12. The "Detroit" led the squadron to the harbor, and the "Iowa" fired on Morro fort and the "Detroit" followed at short range, and the others in the order named, with the exception of the "Montgomery," steamed in an ellipse before the forts. The first round of the firing was aimed too low, but in the second round the ships got the elevation and silenced the guns of Morro. They also fired upon the town and repeatedly drove the Spaniards from their guns. The forts mounted seven good guns, but their markmanship was wretched. They fired hundreds of shots, but they only hit the "New York" and the "Iowa" once each, doing no damage except to kill one seaman and wound six others. The bombardment lasted three hours and the fortifications were completely reduced, and havoc was wrought in the city by the shells of the fleet. Admiral Sampson retired to Mayaguez after the bombardment, as he had no intention of capturing the town, his intention now being to engage the Spanish fleet.

We will now consider the island of Porto Rico and will glance briefly at its history. Our engravings are made from photographs recently taken in the island and show some of the scenes in this tropical land.

Porto Rico, the fourth in size of the Greater Antilles, lies 70 miles west of Hayti and it is about a thousand miles, as the crow flies, from Havana to the harbor of San Juan du Puerto Rico. It forms an irregular parallelogram, 108 miles long and 37 miles broad; its area is 3,550 miles, which is less than that of the island of Jamaica, or about seven-tenths that of the State of Connecticut. The northern coast is rugged, and at the eastern end of the island it is very high and the cliffs extend in almost an unbroken line from Cape San Juan to the port of the same name. Porto Rico is traversed from east to west by a range of hills which are so situated that the streams flowing north are much longer than those flowing to the south. The highest part is near the northeast corner, and the highest peak, Yunque ("Anvil"), is 3,600 feet high and can be seen for a great distance out at sea. The mountain ranges serve to divide the island into two parts as regards climate. As the hills and mountains intercept the northeast trade winds with their rain clouds, there is sometimes almost a superabundance of moisture in the lowlands of the north, while in the south severe drouths occur and the land demands artificial irrigation, which is, as yet, carried out with very little system. The island is, on the whole, well watered. Over 1,300 streams have been counted, of which 47 are considerable rivers. The island is rather beautiful in appearance, forests still covering all the highest part of the hills, but the interior seems to be one vast system of mountains, and from the deck of the steamer there seems to be a limitless sea of hills with rounded summits and with such gentle slopes as to be susceptible of cultivation to their very summits. In reality, however, it is level compared with the other West Indian islands. It is strange that few of the rivers are navigable even at their mouths, and vessels of small burden can ascend them only for a few miles.

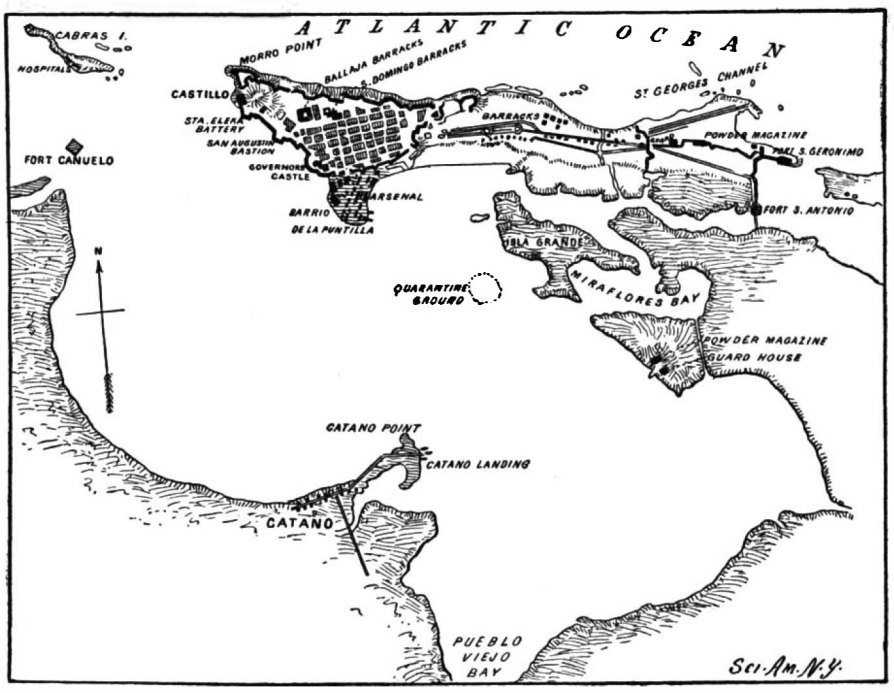
The climate is such that foreigners are easily acclimated, and fevers there have the reputation of not being as contagious or as dangerous as in Cuba and San Domingo.

The residents are acclimated to fever and do not suffer much, but the casual visitor in the summer is in danger. The climate is divided generally into two seasons, the wet and the dry, or there may be two brief rainy seasons, when the sun passes over the earth in the vernal and autumnal equinoxes; and in the latter the hurricanes occur. The dry months are usually from November to April inclusive, and the wet are from May to November. The longest day scarcely exceeds thirteen hours, and the difference between the maximum and minimum of heat is much less than with us; in summer the annual mean being about 75° to 80°, with the daily range of not much more than 10° and an average winter temperature of 70°. Then there is the daily alternation of sea and land breezes, the former setting in about nine in the morning and continuing through the day, the latter beginning soon after sunset and holding until an hour after sunrise, the hottest times being in the intervals between the two. The worst natural characteristic of the island is the tremendous hurricanes that sweep across it between the months of July and October.

Porto Rico was discovered by Columbus, in November, 1493, and in 1510 Ponce de Leon founded the town of Caparra, which was soon after abandoned, and with more success in 1511 the city of San Juan Bautista. The native inhabitants were subdued according to the usual methods of colonization which were adopted by the Spaniards, by sweeping them entirely away, and from that time on, the island was left to fill up with Spanish and slaves. It has therefore been very nearly a detached section of Spain itself, and has kept in closer sympathy with the Spanish government than has any of her other colonies in the western hemisphere. In 1595 the capital was sacked by Drake, and in 1598 by the Duke of Cumberland, and it had other sieges, for in 1615 Baldwin Heinrich, a Dutchman, lost his life in an attack on Castillo del Morro. The attempt of the English in 1678 was equally unsuccessful, and Abercromby in 1797 had to retire after a three days' siege, though in the same campaign he captured Grenada, Demerara and Trinidad. In 1820 a movement was made toward a declaration of independence on the part of Porto Rico, but Spanish supremacy was completely re-established in 1823, and the last traces of slavery were abolished in 1873 by the abrogation of the system of forced labor. In 1870 Porto Rico was made a province of Spain instead of a colony. Recently, when the so-called system of autonomy was offered to Cuba, Porto Rico received the same. It now has a premier and a house of representatives and all the other forms and shapes of a representative government, but they are all in the hands of the Spanish oligarchy that controlled the island while it was still a colony. Like Cuba and the Philippines revolutionary parties existed in Porto Rico; its leaders are exiles living in Europe and the United States. The discontented elements of the population, which are by no means small, have not dared to fight, lest Spain import a greater army and sweep them off the face of the island, the military roads making concentration of troops easy. The insurgents are in no shape to battle with the 40,000 troops Spain keeps on the island, but they are hoping for some good to come to them as a result of the war over Cuba. The inhabitants of Porto Rico numbered, in 1877, 813,937, the negroes being over 300,000.

In Porto Rico the entire land has the appearance of a picturesque and continual chain of habitations, the land being under good cultivation, with fields of sugar, plantains, coffee, patches of rice, etc. There are some sixty towns and villages on the island, but it is really a land of fertile farms between the innumerable hills and mountains and rich valleys. The soil everywhere is very fertile and cultivable, even to the mountain crests, the pastures of Porto Rico being famous for the succulent qualities of their grasses, upon which feed cattle and horses. These are shipped in great numbers, and constitute the chief wealth of a great many people engaged in the business. Among the hills also are thousands of coffee plantations, for here the soil is good and the climate is adapted for its perfect development. In the valleys also grow the sugar cane, cocoa, bananas, plantains, in fact, all sorts of tropical fruits. The banana industry has been vastly increased in the island of Jamaica during the past five years and it has rescued many a planter from ruin. This will also be the case in Porto Rico, which has everything for its profitable cultivation, provided proper attention is given to growing them. With its wonderful range of vegetable products and consequent facilities for subsistence with the minimum of labor, Porto Rico may well be termed an earthly paradise; but while nature has done everything for this island, the race whom the accident of discovery placed in power have done worse than nothing toward its development. Poverty exists everywhere, since the taxes are so oppressive, administered as the government is by alien office holders assisted by foreign soldiers. The island has 470 miles of telegraph and 137 miles of railway, besides 170 miles which is under construction.

San Juan is the capital of Porto Rico and has about 28,000 inhabitants. It is on the northeast shore of the island. The harbor, as will be seen by our map, is one of the finest in the West Indies, being large, sheltered and capable of accommodating any number of the largest ships, having anchorage in it from three to seven fathoms. It bears a striking resemblance to Havana Harbor, to which it is but little inferior. Its entrance toward the north is invitingly open to the vessels of our great republic. Its entrance is over 2,000 feet wide and is defended on the west side by forts erected on two small islands. On the east side of the harbor is an extensive sand bank, but the entrance to the harbor has no sand bank. The harbor is big and deep, but the coral formation makes it impossible for ships of any great draught to get close up to the wharves. The city occupies all of what is generally supposed to be an island, but it is not really built on an island at all, but on a coral reef at some distance from the shore for a great part of its length and joined to the main island at the eastern end by a short bridge. The town is completely inclosed within massive walls of stone and mortar, which rise to a height in some places of from fifty to one hundred feet. Like Havana, which has its "Morro" or citadel (literally a round Moorish tower), it has, or rather had, fortifications on an extensive scale, with bastions and drawbridges, with sentry boxes hanging over the sea and grim, gray walls towering threateningly. One may find a very counterpart on a small scale in the old fort at St. Augustine and every way similar to those at Havana before her walls were torn down.



MAP OF THE HARBOR OF SAN JUAN.

The peninsula upon which Morro and the lighthouse stands is thrust out into the sea, one side breasting the thundering surges of the Caribbean Sea and the other guarding the placid waters of a beautiful and almost landlocked harbor. The old forts suffered terribly from the shells of Admiral Sampson's fleet and offered but little effective resistance to the fire of the modern rifles. They had an advantage over a fleet in being at a considerable elevation, thus enabling them to deliver a plunging fire. Until early in last year the only battery of any consequence was placed toward the east coast, designed specially to protect the city from an anticipated attack on the land side. The battery has several Krupp guns of medium caliber. It is believed several more of these were mounted in Morro Castle at the other end of the town. The remainder of the ordnance in San Juan along the walls was, until very recently, of an obsolete pattern and unserviceable against the armor of modern ships. A large number of rifled guns were sent to San Juan from Spain about three months ago, and recent reports indicate that they have been mounted. There are forts and batteries all along the outer edge of the reef.

Though the main portion of San Juan is inclosed within the walls, through which entrance is obtained only by well guarded gateways, yet there is a small town by itself in the Marina between the fortifications and the wharves. Here is a fine public garden and pleasure space for booths and restaurants as well as the public cockpit where battles royal are frequently waged. The buildings of the inner city are of stone, massive and substantial like those of Havana and the city of Mexico, and are of the old world type, which would not furnish much food for a conflagration in case of a bombardment. Here the captain-general and chief officials reside. Many of the wealthy inhabitants have summer residences at Bayamon, and the very poor live in the huts shown in one of our engravings. The "Morro" is an interesting place with its deep dungeons and covered ways.

San Juan is not a very attractive city under its present conditions, owing to its filthy streets and lack of attention to sanitation. The only thing that saves the city is its being built on a declivity and it is therefore fairly well drained. Yellow fever is quite prevalent. That the city is not a healthy one is shown by the frequent funeral processions that pass through the streets to the cemetery, which lies between the sea wall of the fort and the shore, the interments being in columbarie. San Juan is only one port of the islands, and there are some harbors that are as fine, if not as large and land-locked. The other most notable city is Ponce, having a population of about 35,000.

The total revenue for 1894-95 was $5,454,958, while

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the expenditure was $3,905,667, very little going for public improvements. The principal exports in 1896 were coffee, valued at $2,500,000 ; sugar, $3,500,000 ; tobacco, $425,000, etc. The total exports in 1895 amounted to $15,799,000, and the imports to $17,446,000. In 1895 1,077 vessels of 1,079,036 tons entered Porto Rico. From a commercial point of view the acquisition of Porto Rico would be important to the United States.

Recent Archæological News.

The finds of old gold and silver coins at Santiponce, near Seville, have brought many antiquarians to the spot. The excavations have been continued with great zeal, and among the latest finds are a Roman marble statue in complete preservation, an amphora and some fine mosaics. But more interesting still is the location of the walls of ancient Italica, a portion of which has been laid bare. They were made of roughly formed stone and mortar without battlements, but a truncated square tower in a perfect state of preservation is the latest discovery. Santiponce is among the hills that bound the valley of the Guadalquiver on the west and is about three miles from Seville, which is across the river on the other side of the valley. The town of Italica was founded by Scipio Africanus in the Second Punic War. It was the birthplace of the Roman Emperor Trajan.

The Forum of Augustus is the cats' home of Rome. There the superfluous felines are dropped over the wall to join their numerous fellows in the Forum below. Every day charitable people throw scraps of food into this open prison, and, as seen from above, its inhabitants seem to be plump and happy—so happy, indeed, that they make no attempt to escape. A few years ago the Forum of Trajan was also used as a depositing place for cats that were not wanted, but as it does not present the same facilities of retreat and hiding as the Forum of Augustus, street boys and others took every opportunity of stoning the unfortunate animals. Finally, the authorities, after many complaints, refused to allow any more cats to be thrown there, and, in order to get rid of those already living in the Forum, presented one to each sentry box on the walls of the city. They all, however, speedily disappeared from their new homes, some returning to the foot of Trajan's Column, where they were either killed by the street boys or transferred to the Forum of Augustus.

The Institute of France has formally entered into possession of the Château of Chantilly, says The Builder, and the collections included in what is now to be called the Condé Museum, the contents of which have been inventoried in five volumes, with indications of the arrangement of the various classes of objects according to the intention of the Duc d'Aumale. The museum contains 557 pictures, without counting the pictures, engravings and drawings which adorn the Château d'Enghien ; 30 enamels ; 282 miniatures ; more than 200 gems and precious stones displayed in glass cases ; and in addition to the equestrian statue of Condé, by Paul Dubois, about 50 statues and busts in marble, among which are three by Chapu ("Jeanne d'Arc," "Pluto" and "Proserpine"), a "Hebe" by Dezeine, the statue of Bossuet by Guillaume, two bas-reliefs by Jean Goujon, and animal sculptures by Gardet and Auguste Caïn. Among the 12,600 drawings are 111 original drawings by Nicholas Poussin and more than 500 by Raffet. Besides these are 5,000 engravings, a collection of 3,685 medals and a library containing 24,000 printed volumes, 1,493 MSS. and 272 parchments. The château includes besides more than 500 pieces of furniture and other objects of great value —armor, tapestries, etc. There is also a collection of autographs and historical documents of great interest.

Herr Ernst Berger, in his "Contributions to the History of the Development of Painting," describes the way the colors of the ancients are examined by chemists as follows: The color layer is first carefully scratched off with the knife in order to separate the colors from the lower ground. A portion of the color powder thus obtained is dissolved in water and heated in a retort ; then the binding materials, dissolved in water, are separated from the color pigments by filtration. The filtrate is evaporated, and from the residuum the binding agent present is determined, according to whether it contains organic substance or not ; ashes which turn brown with a burning smell point to organic binders, likewise the presence of ammonia (ammonia is recognized by the odor or by means of turmeric paper, which is dyed brown by ammonia vapors). A second portion of the scraped-off powder is treated with boiling alcohol, which dissolves the fatty resinous substances ; the mass is filtered as above, and the filtrate is evaporated in like manner ; from the residuum, which takes on a dark color, an oily or resinous binder results, which can be determined more closely by the odor. In order to recognize the presence of lime, a drop of hydrochloric acid suffices, which causes effervescence. The color substances remaining in the filter are then tested by means of different reagents for the presence of metals, earths, etc., and conclusions are drawn accordingly. In exactly the same manner the foundations on which the painting was are tested.

Correspondence.

The Naval Supplement.

To the Editor of the SCIENTIFIC AMERICAN :

I desire to express to you my appreciation of the excellence of the NAVAL SUPPLEMENT your paper has recently issued, and especially so because, instead of representing, as is so often done, our vessels as superior to anything else afloat, it frankly calls attention to certain of their limitations, e. g., the low freeboard of the "Indiana" and "Kearsarge" classes, and also to the doubts regarding the desirability of the superposed turrets of the "Kearsarge" class.

It is only by teaching our people regarding the shortcomings of their present vessels that a demand for better ones can be created, and nothing short of the best at the time of construction should satisfy us.

Furthermore, exaggerated ideas as to the excellence of our vessels, as compared with those of other nations, may lead to unpleasant consequences.

Permit me also to express the hope that you will follow the publication of this NAVAL SUPPLEMENT with one on United States ordnance, both that of the navy and of the army, including in the latter the armament for coast defense.

May I suggest that in such a supplement especial attention should be given to the subjects of rapid-fire guns, projectiles and smokeless powder, and that should you, on investigation, conclude that we are behind any other nation in adopting useful inventions, or have failed to keep our ordnance up to the highest standard, either in the matter of guns or that of ammunition, you should frankly say so ?

Comparisons such as have appeared in various publications, e. g., between the efficiency of the armament of our "New York" and that of the Chilean "Esmeralda," or that of our "Kearsarge" and the Japanese "Fuji," of the muzzle energy of our guns as compared with those of the same class in the English, French and German services, etc., would, I think, be of interest if published in such a supplement.

EDMUND M. PARKER.

Boston, May 11, 1898.

An Electric Railroad for Freiburg.

To the Editor of the SCIENTIFIC AMERICAN :

The city of Freiburg, a town of 55,000 inhabitants, with most beautiful surroundings, many large villages near by and romantic valleys into the heart of the Black Forest, is contemplating the building of an electric railroad system and a central power station for electric light and locomotive power.

Competition for these new enterprises is open to the world, and as United States consul I consider it my duty to call the attention of American manufacturers to the same, and feel that your valuable publications are the best medium for that purpose ; hence send this note to you.

Freiburg is a busy little city, very conservative and slow but sure in whatever it undertakes, and whatever is constructed here is built, not for a day or lifetime, but for an age.

"Rapid" transit they have here, but it is the old-fashioned omnibus. Electric light is seen nowhere but in several factories with private motors and dynamos. Hence the need of these new enterprises and the call for bids for the same, such bids to be in the hands of the Committee on Underground Structures (Tief-bauamt) before July 1, 1898.

I mail you under separate cover the circular letter, plan of the city, plans and profiles of the projected enterprises, etc., such as the above-mentioned committee sends to parties interested, and shall be glad to procure any further information for you or other Americans who may take an interest in this matter.

E. THEOPHILUS LIEFELD,
United States Consul.

Freiburg, Baden, Germany, April 29, 1898.

The Current Supplement.

The current SUPPLEMENT, No. 1168, contains articles of general interest to our readers. "The Use of Aluminum in Bicycles and Light Machinery" describes some of the latest advances in the use of this metal as a substitute for brass, steel and iron. "The Report of the Building Committee of the Scientific Alliance of New York" outlines an interesting plan for the co-operation of scientific societies. "The Great Shore Battery of Krupp Guns at Cuxhaven" is a subject of a splendid full page engraving. "Recent Work in the Princeton Psychological Laboratory" is the subject of an interesting article by Prof. J. Mark Baldwin. Papers of this nature in which psychology is treated in a popular yet clearly scientific manner are rare. "Malay Life in the Philippines," by W. G. Palgrave, is continued from the last number. It is one of the most important contributions ever made to the literature of travel in the Philippines.

THE French mint, besides coining money for the home country and her colonies, has also last year received and filled orders for Abyssinia, Bolivia, Chile, Morocco, and Russia.—La Science en famille.

Science Notes.

M. Phisalix announced to the Académie des Sciences, Paris, some time ago, that cholesterine injected into the blood of animals made them resist the venom of vipers. Doubts were thrown on his results, because he had used cholesterine of animal origin. Since then he has repeated his experiments with crystallized cholesterine extracted from carrots, and found it as effective as that from animals. Moreover, he has obtained similar results with crystallized tyrosine extracted from the dahlia and even with the sap of the dahlia.

Mr. W. H. Wheeler draws attention in Nature to the effect of gales on tideless lakes and seas, which he says is at times so marked as to cause considerable inconvenience and anxiety to mariners. Thus in the Caspian Sea a gale will raise the water on one side six feet and depress it on the other as much, making a total difference of level of twelve feet. In the Baltic easterly gales will alter the level upward of eight feet. In Lake Erie depressions and elevations of from two to four feet are common, while occasionally heavy gales have produced a difference of level of upward of fifteen feet.

When drawing attention, about a year ago, to the bipedal movements of certain Australian lizards, notably the comical little chlamydosaurus, or "frilled lizard," whose photograph is now familiar, Mr. Saville-Kent referred to an unconfirmed rumor that the Mexican iguanoid lizard also possesses the power of running on its hind legs, being led to this by the correspondence in general structure of the creatures, especially the abnormal length of the hind limbs. In Nature he publishes a letter from a gentleman living in the West Indies, which shows that there also all the lizards, from the large tree iguana, five feet long, down to the tiniest mites which scamper about among the stones, are accustomed to run erect on their hind legs when hurried. The correspondent adds the interesting information that on the rocks about the watershed of the Guiana are old drawings of lizards running erect. Mr. Saville-Kent points out that this peculiarity, which a year ago was doubted by many naturalists, but which has now been shown to be common to so many different species of lizards, deserves attention as pointing to bipedal locomotion in some remote ancestor.

Mr. F. G. Jackson's account of his three years' exploration in Franz-Josef Land is the prominent feature of The Geographical Journal for February. The main result of his adventurous journeys seems to have been the mapping of the southern part of the archipelago, and, it may be added, the conviction that it is "one of the worst" routes to the pole. A study of the geological collections brought back by the expedition appears to show that the islands are fragments of a vast basalt plateau, probably the "grandest example of volcanism in the world." On account of the absence of warm southwesterly winds, the flora is "more scanty and stunted on the whole than that of almost all the other Arctic regions." There are certain plants, however, as poppies and four species of mosses—brilliant green, red and golden yellow—which give color to the landscape. The only land mammalia are the bear and the fox, but three new species of birds were discovered. The northern lights were disappointing, though occasionally they were brilliant enough "to cast a shadow and to eclipse stars below the third magnitude." The highest registered temperature was 43° Fah. ; the lowest, —54°. The Journal also contains Dr. Mills' elaborate classification of geography with arbitrary symbols, presented at the Toronto meeting of the British Association.

The chemical and toxic properties of the poison of the honey bee have been a subject for long study by a German scientist, Dr. Joseph Zanger. During his investigations Dr. Zanger employed 25,000 bees. He found that the fresh poison is clear, like water, of an acid reaction, bitter taste and of a fine aromatic odor. On evaporating and drying at a temperature of 100° Centigrade (212° Fahrenheit) a gummy residue is left. It is soluble in water ; with alcohol it forms an emulsion-like mixture. The aromatic odor is due to a volatile substance, which disappears on evaporation, and is not poisonous. The poisonous constituent is not destroyed by short boiling, nor by drying and heating the residue to 212° Fahrenheit, nor by the diluted acids or alkalies. Dr. Zanger has proved the existence of formic acid, but he has also proved that that is not the poisonous principle. The latter is an organic base, soluble with difficulty in water, but kept in solution by an acid. On the healthy skin neither the bee poison nor a two per cent solution of the poisonous principle has any effect, but they act as powerful irritants on the mucous membranes. His tests made on rabbits and other animals show that when the poison is brought in contact with the eye there follow lachrymation, hyperemia, chemosis and croupous membrane on conjunctiva. The general condition is also affected ; the animals become melancholy, take no food, but are very thirsty, and the urine shows small amounts of albumen.

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THE RAPID-FIRE GUNS OF THE "NEW ORLEANS."

In our issues of March 26 and April 9, we have described and illustrated the "New Orleans," one of the twin boats recently purchased from the Brazilian government. We are now enabled, through the courtesy of Capt. Folger, who is in command of the vessel, to present some excellent views of the main battery of rapid-fire guns. The armament is entirely of the rapid-fire type, and as we have shown in the articles referred to, the energy of the metal thrown in a given time is exceptionally great for a vessel of 3,600 tons displacement.

The main armament is made up as follows: There are three 6-inch rapid-fire, 50-caliber guns forward (see Fig. 3), one on the forecastle deck, and one sponsoned out on either beam on the gun deck; three 6-inch rapid-fire guns aft, one on the poop (see Fig. 2), and two in sponsons on the gun deck. Of these guns, three can be trained dead ahead, three dead astern, and two on either broadside. On the gun deck, in broadside between the 6-inch guns, there are also four 4·7-inch rapid-fire guns. The secondary battery consists of ten 6-pounders, of which six are on the gun deck, and four on the poop and forecastle deck. The starboard 6-pounder on the poop is shown in Fig. 2, just beyond the chase of the 6-inch gun. In the foreground of the same picture is seen one of the two field guns, which would be taken in boats by a landing party for offensive operations on shore.

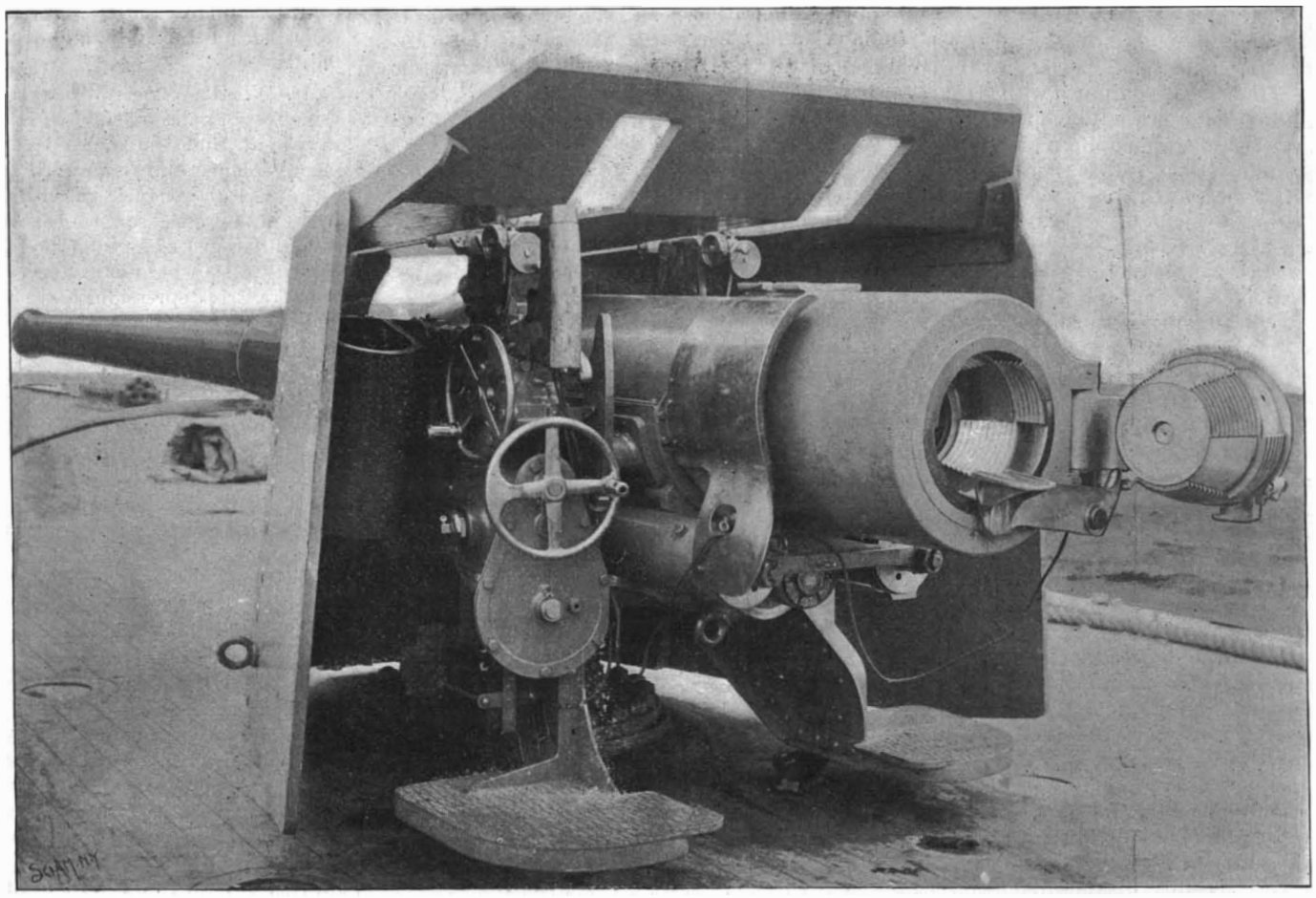

Fig. 1.—6-INCH RAPID FIRE GUN ON UNITED STATES SHIP "NEW ORLEANS"—BREECH OPEN.

Those of our readers who are familiar with the appearance of the larger rifles will notice that these guns are unusually long, the length being 50 calibers or 25 feet. It is only a few years since 35 calibers was the limit for rifled guns. The increased length is adopted to secure greater velocity. With a given charge of powder the velocity of a shell will be proportional to the time during which the gases of explosion act upon it in the bore of the gun. The longer they can exert their pressure upon the shell, the greater will be the velocity with which it will issue from the muzzle.

The action may be likened to that in throwing a baseball. If the player wishes to send the ball slowly for a short distance, the hand is only drawn back slightly behind the body; but if he wishes to throw it as swiftly as possible, the arm is drawn back to its full reach, so that the propelling power of the hand and arm may act upon it for the greatest possible length of time. So in the gun, great length means a greater time for the powder pressure to act, producing greater velocity. There is, of course, a limit to the length on account of the unwieldiness, though Canet, the French manufacturer, has built guns of 60 and 80 calibers.

The increase of energy due to increased velocity is extremely valuable in the navy, where it is desirable to save all possible weight. If by increasing its velocity we can make a 5-inch shell penetrate as far as a 6-inch shell, we can save about one-half the weight of a 6-inch battery. It is considered that, so long as the shell can be put through a ship's armor, its size is of secondary importance. If an 8-inch shell could be made to penetrate the side armor of a ship and burst in the engine or boiler room, it would be certain to disable the ship almost as surely as a 10-inch or 12-inch shell.

To show what velocity will accomplish it may be noted that a 4-inch 40-caliber gun has a muzzle energy of about 1,000 foot-tons and will penetrate 10 inches of iron at the muzzle; whereas an 80-caliber gun of the same bore has 2,055 foot-tons of energy, a muzzle velocity of 3,215 feet per second and a muzzle penetration of 18·7 inches. Again, the 6-inch 30-caliber gun, with a velocity of 2,000 feet per second, penetrates 14 inches of iron at the muzzle, as against 2,642 foot-seconds velocity and 21·2 inches penetration for the 50-caliber 6-inch gun mounted on the "New Orleans."

It was largely the 5-inch, many-calibered, rapid-fire batteries of Commodore Dewey's squadron that swept the Spanish fleet out of existence by the awful hail of shells which they poured upon it.

The 6-inch gun of the "New Orleans" is carried in a trunnion sleeve or seating, in which it slides. It is held in the forward or loading position by coil springs, inclosed in two cylinders which form part of the seating. Attached to the gun are two pistons which travel in the cylinders, the latter being filled with glycerine. When the gun is fired, the gun slides back in the sleeve, carrying the pistons with it, and the recoil is checked by the resistance set up by the glycerine in traveling through the pistons, the passage of the fluid being throttled by a gradually closing valve. After the gun has made its full recoil it is returned to the loading position by the action of the coil springs, which are compressed during the recoil. The gun and the gun crew are completely protected on the front, sides and overhead by a Harvey steel shield, which is 4 inches in thickness in front of the gun. The shield comes down close to the deck, and, as it is bolted to the carriage and rotates with it, the crew are safe from machine gun bullets and the lighter rapid-fire shells. The sights, of which there are two separate sets, one on each side of the gun, as shown, are attached to the trunnion sleeve and are not affected by the recoil. The gun is carefully balanced upon a conical mount, which is firmly bolted down to the framing of the deck. It rotates on a race of steel balls, and the balance, when it is in the loading position, is so perfect that the whole piece, weighing over 7½ tons, can be moved with a very slight pressure. Attached to the left hand side of the carriage and swinging with the gun is a

Fig. 2.—A 6-INCH RAPID-FIRE GUN ON THE "NEW ORLEANS" AT ITS MAXIMUM ELEVATION FOR RANGE OF SIX MILES.

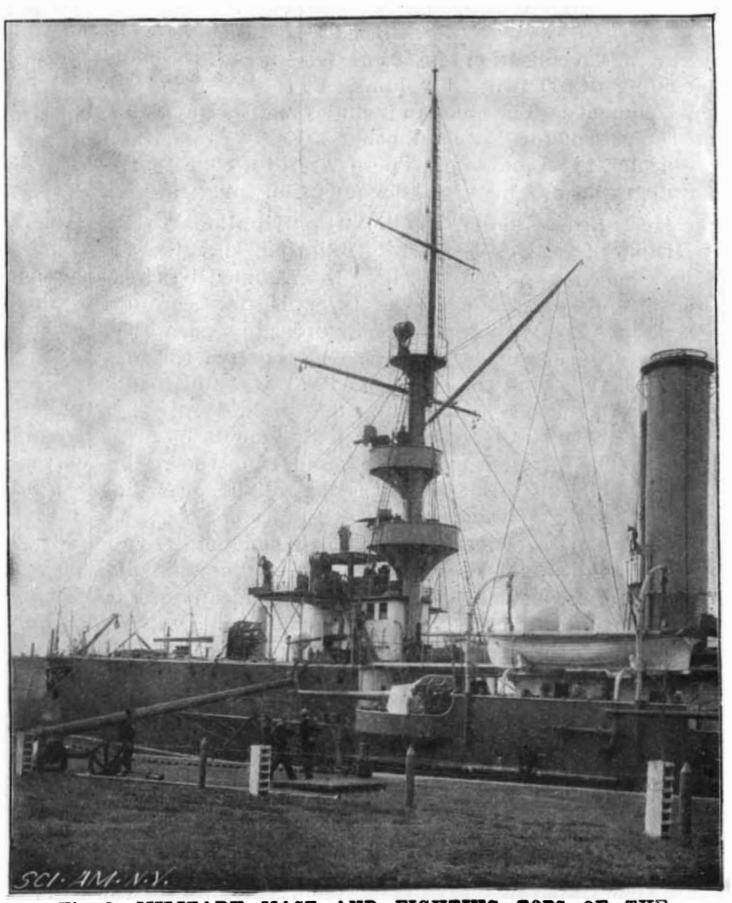

Fig. 3.—MILITARY MAST AND FIGHTING TOPS OF THE "NEW ORLEANS."

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platform, upon which the gunner stands. A similar platform is hung from the right hand side of the carriage and in line with the right hand sights. Just in front of the gunner are two hand wheels, one vertical, one horizontal, for training and elevating the piece. In front of the platform is stowed away a small electric battery from which wires lead to the breech block for igniting the charge. This is done by the gunner pressing a small rubber air bulb.

It is possible that the murderous hail of bullets from an enemy's machine guns may find its way through the open slots in the shield and carry away the sights. If this should happen, the gun could be given the proper elevation by means of the graduated elevating arc, which can be seen to the right of the gunner. On the inside of the shield to his left is a table giving elevation for various distances, and from this he can read off the proper number corresponding on the arc to the distance of the enemy's ship.

We explained in our last issue that the speed of the rapid-fire gun was due to the fact that the shell and charge were put in a metallic cartridge case, and that the sights were fixed to the gun carriage and not to the gun, thus obviating the necessity for re-sighting after each discharge. A 6-inch gun of the kind carried by the "New Orleans" has fired 7 rounds in 61 seconds, and the 4·7-inch gun has a record of 5 rounds fired at a target in 22 seconds.

The breech block, it will be seen, is different from that shown in the Dashiell mechanism (SCIENTIFIC AMERICAN, April 30). The block, instead of being made cylindrical, is conical or tapered, to enable it to be swung open without first drawing it back clear of the breech in line with the axis of the gun. The breech is unlocked and opened with one continuous swing of the lever from left to right. The first part of the swing gives a partial turn to the threaded block, bringing the threaded portions opposite the longitudinal channel ways, which are cut across the thread in both the breech and the block. The continued motion of the lever swings the block out of the breech into the position shown in one of the figures. There are thus only two motions of the breech block instead of three. At the end of its travel, the lever moves an extractor which loosens the empty cartridge sufficiently for it to be drawn from the gun by hand.

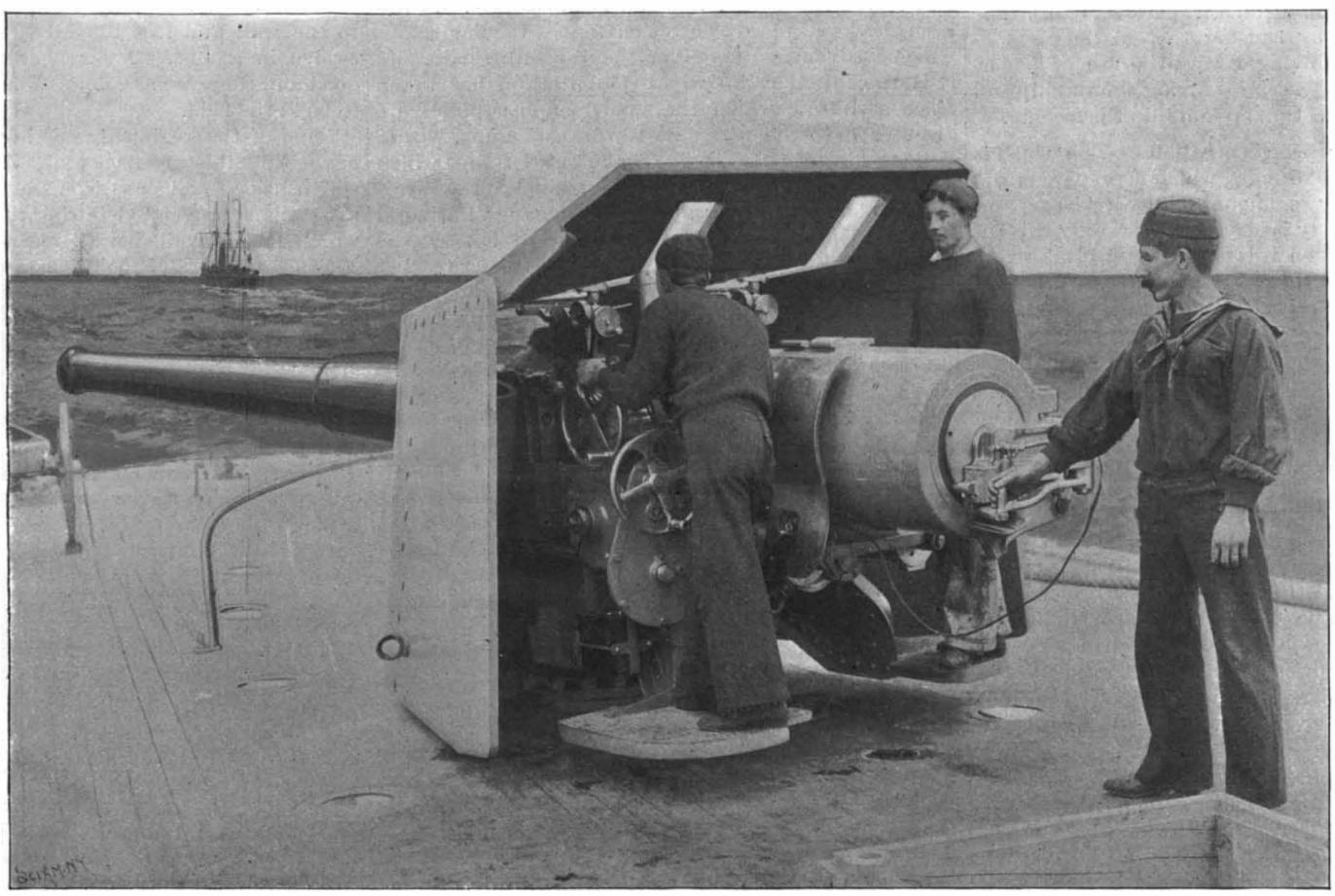

Fig. 4.—SIGHTING A 6-INCH RAPID-FIRE GUN BREECH CLOSED.

The small tray seen just in front of the open breech is a brass guide piece, which automatically rises to protect the thread from being bruised by the shell when the cartridge is thrust into the breech.

One of our views shows the gun at its maximum elevation, corresponding to a range of six miles. This is not the maximum range of the gun, for, with 45° elevation, it could throw a shell some nine or ten miles; but the stresses set up in the framing of the ship by such an elevation would be prohibitive. It is for the reason that guns cannot be given their maximum elevation on shipboard that the possibility of long range bombardment is very remote in the case of most of our fortified cities. The 11, 12 and 13½-inch guns of foreign navies are not capable of nearly as great an elevation as the gun herewith illustrated, and their bombarding range would be proportionately limited.

One of our illustrations of the "New Orleans" shows the forward military mast with its double tops. In the lower top are two 1-pounder guns, together capable of firing 50 to 60 shots a minute. Above them, in the upper top, are two Maxim machine guns, each of which could pour leaden bullets out upon the enemy like water from a hose. The combined capacity of the two is over 1,000 shots per minute. Two tops, with a similar armament, are carried on the mainmast.

DR. ALBERT C. PEALE reports to the government that there are 8,822 known mineral springs in the United States. Many more may be discovered.

The Destruction of the "Maine."

The following letter was published in the latest issue of the English journal Industries and Iron, and it possesses so much interest and is from the pen of so high an authority that we publish it in full:

SIR: I have been much interested in the article on the "Maine" disaster which appeared in your issue of the 22d inst. I am an old and experienced engineer. I am also an expert in explosives. I have witnessed experiments in which many tons of high explosives have been used, and I give it as my opinion that the "Maine" must have been blown up by an extremely large submarine torpedo exploded from the outside of the ship.

I am aware of the fact that a good many so-called engineers pretend to be of the opinion that the explosion was from the inside of the ship, but I would like to ask how it could be possible for an internal explosion to blow the keel upward; if the explosion had been from the inside, it would certainly have blown the keel downward and outward. There cannot be the least question about this.

It will be remembered that some years ago extensive experiments took place at Portsmouth, when torpedoes were exploded against and under the "Resistance." It was found on that occasion that the destructive effects of the ordinary Whitehead torpedo were nothing like what had been expected; that very little damage was done, and that it was a most difficult matter to sink the old ship with the torpedoes used at that time, which, I believe, carried about sixty pounds of guncotton. The "Maine" is a stronger and heavier ship, and was blown completely to pieces by the explosion, the keel and bottom plating being actually blown up through all the decks, so that some parts of the bottom plating are now above water. This would show that an extremely large charge of high explosives was employed—certainly five hundred pounds. Would it have been an easy matter for any private individuals, no matter how evil-minded they may have been, to obtain in Havana five hundred pounds of high explosives, to have packed them in a torpedo and to have placed them under the "Maine" and exploded the charge? I think not.

Some of the French and Spanish engineers combat the torpedo theory by asking why no dead fish were found. In reply to this I would say that, if the torpedo was placed in close proximity or in actual contact with the ship, the explosion would have relieved itself by discharging the gases through the ship, instead of producing the violent concussion of the water which is necessary to kill fish. It has also been said that little or no water was blown into the air. Very true. There was no water above the torpedo, the torpedo was probably in direct contact with the bottom of the ship, and when exploded it found vent through the ship, as being the direction of least resistance, it being remembered that, when these high explosives are employed, the inertia of the mass counts for much more than the strength of the materials.

I have read with the greatest care the reports from all parties relating to this disaster, and as an engineer I defy anyone to show how the ship could have been distorted in the manner shown except from an explosion outside of the ship. At any rate, I feel sure that every American believes most implicitly that the ship was blown up by a Spanish government torpedo. And it is no use disguising the fact that the Americans have gone to war with Spain, not on account of the Cubans, but on account of the destruction of an American battleship and some two hundred and fifty American seamen. No beating round the bush will change this fact. I inclose my card.

I am, yours, etc.,

AN OLD CIVIL ENGINEER

London, April 28, 1898.

The "Windward" Arrives.

The "Windward," the Arctic exploring ship which was presented to Lieut. R. E. Peary, U.S.N., the Arctic explorer, by Mr. Albert Charles Harmsworth, owner of The London Daily Mail, arrived at New York, May 11, after a rough passage of fifty-two days. The "Windward" came over under sail, using her steam in the English Channel and during the closing hours of her trip only. She took a southerly course to avoid bad weather, and after she reached the latitude of the Bermudas, on April 26, she met a succession of heavy northwest gales.

The vessel is at present off Tompkinsville, S. I., as the navy yard at Brooklyn is too crowded with vessels to permit of her reception there. The "Windward" was brought over by Capt. Reid, of the Royal Naval Reserves, and a crew of twenty-seven men. The "Windward" is one of the stanchest Arctic vessels ever built. She was specially constructed for ice work and is fitted with all of the most modern improvements and conveniences.

Mr. Harmsworth had the vessel completely overhauled after she returned from the Jackson-Harmsworth expedition in Franz-Josef Land, and had new engines put in her, but it is said the engines are not as satisfactory as had been hoped for. She is brig rigged and is arranged so as to make the handling of the ship as easy as possible and give the crew little work above deck. On the maintop is a barrel lookout for the ice master. The displacement of the "Windward" is 246 tons, her length is 118 feet, beam 28 feet, draught 16 feet; her hull is built of three thicknesses of oak, 3 feet thick amidships and thicker at the bow and stern. The ram bow is made of solid oak, 13 feet thick, protected by steel. We have already given accounts of this magnificent gift of Mr. Harmsworth and also of the expedition to Franz-Josef Land. The "Windward" is notable as being the vessel which took Nansen and Johansen from Franz-Josef Land to Norway. Lieut. Peary's plan has also been outlined. He will leave in July for the North, and as the expedition may be gone several years, the "Windward" will carry stores from New York at intervals of a year or two.

New Mines in the South African Republic.

Rich deposits of coal have been discovered at about fifteen miles from Johannesburg and eleven miles from Krugersdorp. The coal-bearing layer is sixty-five yards deep. The new mine supplies much better coal, and is much nearer the gold fields, than the mines which have supplied the coal hitherto. Diamonds have been found at Rietfontein, near Pretoria, and it is estimated that the new mine will be twice as rich as the celebrated Kimberley fields. Mr. Kehler and others have found very valuable gold reefs between Johannesburg and Krugersdorp, at a depth of 2,400 feet.—Cosmos.

A MOUNTAIN experimental observatory has been established on the summit of Mount Kosciusko, 7,328 feet above sea level, and the highest point in all Australia; also a sea level station on the southeast coast adjacent at Merimbula, where simultaneous observations are taken. Simultaneous readings are also taken at a new station in Sydney, at Sale, in Victoria, and at Hobart, and on Mount Wellington, Tasmania.

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Miscellaneous Notes and Receipts.

A New Gold Field.—From Godemesterháza, a town situated at the foot of the Görgény snow mountains, the former favorite hunting grounds of the departed Austrian Crown Prince Rudolf, sensational news reaches us. In the wilderness of the virgin forests, an immense gold field has been discovered. In different places diggings have already been instituted, with the result that in nine cases rich veins of gold were found at a depth of 10 to 12 meters.—Edelmetall-Industrie.

Adulteration of Linseed Oil with Cod Liver Oil.—According to the Pharm. Ztg., this adulteration occurs very frequently, of late. For the detection of this sophistication mix 10 parts (weight) of the oil with 3 parts (weight) of commercial nitric acid in a glass cylinder by stirring with a glass rod; place aside until the oil layer and the acid layer have separated. If the linseed oil contains cod liver oil, the oil layer takes on a dark brown to blackish color and the acid becomes orange-yellow to yellow-brown, while pure oil, after being treated as aforesaid, first shows a water green, later a dirty yellow-green color, the acid taking on a light yellow.

To Mount Photographs on Glass.--According to the Werkstatt, clean the inner hollow side of the pane thoroughly, pour on gelatine dissolved in boiling water, lay the picture on and pour on gelatine again, so that everything swims. Then neatly remove what is superfluous, so that no blisters result, and allow to dry. The following recipe is said to be still better: Gelatine, 16 parts (weight); glycerine, 1 part (weight); water, 32 parts (weight); methylic alcohol, 12 parts (weight). The mixture is prepared by causing the gelatine to swell up in water, then dissolving it with the use of moderate heat, adding the glycerine, stirring thoroughly and pouring the whole in a thin stream into the alcohol.

Chinese Varnish for Wooden Articles.—The wood is coated with a puttylike mass, which is prepared from gypsum, potter's clay, common earthy feldspar and glue. When this putty is dry, it is carefully rubbed off with sandstone; then it is coated with black paint dissolved in lac varnish, and when this is dry a lac varnish is applied, derived from a tree called tsie chou in China, a variety of sumac, whose sap exudes in the form of a gum. In the liquid state this lacquer is so poisonous that it causes painful swellings on the faces and on the hands of those working with it. The varnish must dry in the air, whereupon the decorations are engraved with a graving tool and the pieces of mother-of-pearl are pressed in. The color or gold which one desires to apply is mixed with oil varnish and the whole is lacquered. According to Macaire Princep, the varnish consists of benzoic acid, yellow resin and colorless volatile oil. It has a brown color and a peculiar aromatic odor and a taste similar to that of copaiva balsam. On wood the varnish gives a glossy coating which dries readily. According to the Zeitschrift für Drechsler, it can be dissolved in cold alcohol and still quicker in boiling alcohol, likewise in oil of turpentine.

Waterproof Wax Polish on Oak.—Oak furniture is known to be provided externally with a wax polish. The wax coating enters the cavities of the coarsely porous wood and fills them, imparting a handsome dull gloss to the wooden surface. Complaints were heard everywhere that wood surfaces thus treated were found to be extremely sensitive to water. Every drop of water which touches the polish produces an ineradicable ugly white spot. Wax is a firm substance which cannot be so readily distributed over the wood surface. It must, therefore, be previously transformed into a dissolved state, which is frequently done by dissolving the wax in turpentine. After the application the solvent evaporates and the wax remains finely and uniformly distributed. Another process consists in boiling the wax in water containing soda. A soaplike mass results, consisting of fine wax drops, which are suspended in the liquid similar to the fat globules in milk. This mode of preparation is more recommendable, because it is cheaper than the turpentine solution and also because it can be diluted to any proportion with water. More suitable than soda, however, is potash for preparing the stain. If potash is employed, the liquid attains greater softness and suppleness, enters the wood better and is easier distributed. In case one desires to alter the tone of the wood somewhat, the stain is tinted by the admixture of a pulverized dyestuff or by dissolving a soluble color. In the latter case care is recommended, as the organic coloring matters bleach very much, when exposed to the light. With mineral dyestuff powders this need not be apprehended. Frequently Vandyke brown is added to the stain, as the oak wood receives a dark, pleasant shade from it. A wax polish obtained by applying the aforementioned stain is just as sensitive to water as any other wax coating, but it can be protected from the access of water and the action of same by providing it with a thin coat of rubbing varnish. Such a varnish is obtained by dissolving 6 parts (weight) Zanzibar copal in 5 parts (weight) boiled linseed oil and diluting the mixture with 10 parts (weight) turpentine. This coating dries in one day at most and leaves a dense, firm covering of resinized oil and copal. It is perfectly impervious to water, so that the wax layer under it cannot suffer from any drops of water falling on it. The drop of water may even slowly evaporate on the spot where it has fallen and dry up, without leaving anything else behind than perhaps the lime contained in the water. The latter can be easily wiped off. The proportions of copal, linseed oil and turpentine as enumerated give a good varnish.—D. Allg. Gewerbezeitung.

OUR TROOPS AT CHICKAMAUGA PARK.

Our acquaintance with large bodies of troops is chiefly limited to gala day parades, owing to the fact that the United States has such a small standing army, so that the mobilization of a large body of men, which is so frequent in Europe, has not been seen in this country in this generation. Not only have the troops of the regular army been called to active duty from the humdrum existence of army stations or from the Western plains, but the National Guard of every State is mustering into service up to the limit allowed by the War Department; and over 600,000 men have volunteered their services in the present war, although this is more than four times as many men as are required. The subject of the mobilization of a vast army is so interesting that we take pleasure in presenting views of some of the stirring scenes which have been recently enacted at Chickamauga Park, which is, or rather was, up to a few days ago, the great center of activity.

Chickamauga Park, near Chattanooga, Tenn., is really over the border line and is in Georgia. It has been the point of concentration for the regular troops which are being gathered for the war with Spain, and it is the initial camp where mobilization has taken place and from which the soldiers and supplies are dispatched to the sea coast towns, as Tampa, within striking distance of Cuba. Of the 25,000 troops which make up the standing army of the United States, nearly 20,000 have been in camp at Chickamauga Park and at Port Tampa, Fla., but they have now left for the South, and it is probable by the time this paper reaches our readers 30,000 volunteers will have taken their place. The gathering at Chickamauga Park was the largest concentration of the regular troops which has taken place in this country since 1865, and special interest attaches to it from the fact that the mobilization took place in the South, and the united forces from the North, South, East and West occupied the historic field of Chickamauga, where one of the bloodiest and most desperate battles of the civil war was fought. Almost twice as many laid down their lives in that engagement as were represented in the entire army recently encamped there. The thick woods, open meadows, brooks, hills, everything, in fact, is topographically the same to-day as then.

The regular army, which has been for the most part relegated to Indian fighting in the far West, is now brought together, so that thousands of our people have, for the first time, seen an imposing army, and the troops have created much enthusiasm in the smaller towns and cities through which they have passed. Even before the ultimatum was sent to Spain, the regular army was moving toward Chickamauga, the first troops arriving April 20.

Our large engraving shows the Ninth United States Infantry en route to the South, the photograph being taken from Maryland Avenue, Washington, D. C., and the Capitol of the United States may be seen in the distance. Every incoming train at Chattanooga is met by a throng of people who cheer the soldiers as the train rolls into the station.

It is a busy scene, as the troops load their baggage into the long line of blue wagons with white covers, bearing the brand of the United States, which recalls vividly to the veteran the days when this section of the country was alive with those who followed Grant, Sherman, Thomas and Rosecrans.

The following are some notes on the scenes at Chickamauga Park during the occupancy of the regulars:

While the infantry comes in for a share of enthusiasm, the cavalry is naturally the favorite. When the stock cars reach the platform, each horse knows his master and greets him with some expression of pleasure familiar to himself. The horses first, and all the time, is the motto of the Western cavalryman. As soon as the horses have been saddled, the order, "Mount!" peals out from the cavalry bugle, and the troops are off and down the dusty road leading toward Chickamauga, and when the last of the lumbering wagons following the troops turn out of sight, the crowd again directs its attention to similar scenes, which occur almost hourly.

When the cavalrymen reach the camp ground, a long rope is stretched on the ground and a picket line made, to which the horses are tethered. The affection displayed by the trooper for his horse is reciprocated by the intelligent animals, and it is largely due to this fact that accidents to man and beast are few and far between. The cavalryman always provides for his mount, and it is amusing to watch the mounted artillerymen taking their horses out to good grazing spots the moment the escort dismounts.

"Camp George H. Thomas," as the rendezvous has been named in memory of the hero of Chickamauga, is a bustling scene of military activity. The rattle of the artillery is often heard, and the historic battle ground is now covered to a great extent with the tents of the soldiers, and parties of cavalrymen may constantly be seen driving their horses to water at Chickamauga Creek. The establishment of the community at Camp Thomas is much like the establishment of a colony in an unsettled land, in so far as domestic conveniences are concerned, for everything has to be taken there, and each regiment is a small canvas town in itself, and has to depend entirely upon its own resources. Dotted here and there throughout the entire expanse of fifteen miles of reservation these cities of tents are seen.

The description of the quarters of one officer will serve for all. An "A" or wall tent is 10×12 feet and some of them a size smaller. On one side is a folded camp cot with a thin yet comfortable mattress and an abundance of heavy woolen army blankets. A table about 20 inches square, with legs that fold up into the smallest possible space, stands near the door or opening at the foot of the cot. A folding chair or two for his visitors, a large valise or very small trunk, a bit of looking glass hanging from a tent pole, and a tubular lantern or candle attached to a stick stuck in the ground finish the equipment of the tent. Commanding officers at regimental headquarters have an extra roof or "tent fly," as the awning in front of their quarters is called, but otherwise they live as other officers do. The enlisted men, quartered in conical wall tents now adopted by the army, bunk with heads to the wall and feet toward the center, from nine to twelve in a tent. Their bedding and blankets are good and they are as comfortable as soldiers can hope to be in the field.

Some of the regiments coming from the Northwest have the Sibley conical tent, which has no wall, but which has a small sheet iron stove. These have been more than appreciated during the cold, rainy weather which has prevailed until recently at Camp Thomas. The mess tents and cook houses are nearly alike in all arms of the service. The "cuddy-bunk" oven, made of sheet iron, bakes well and looks like two iron pans fastened together, one upon the top of the other. The men are detailed as cooks and waiters and attend to the preparation and serving of the meals. The soldiers live very well indeed. Field rations are used when in transit from point to point, but when in camp the companies or troop mess purchase fresh meats, vegetables, eggs, fruits, etc. Wells are being driven all through the camp to furnish an abundant supply of pure water. While the soldiers do not have many of the luxuries of life, still they have some of them, as represented in one of our engravings, which shows a camp barber shop, where one of the soldiers is being shaved. The camp barber shop is a primitive affair, of which it has been humorously said that it "consists of a cracker box and a towel." Trades are made between the men and the barber, or sometimes a cash consideration is promised; but "You cut my hair and I will clean your horse" is the average exchange.

The regulations of the camp are as follows: Reveille, 6 A. M.: breakfast, 6:15; sick call, 7; drill by companies, 9; recall drill, 10; recall fatigue, 12 M.; first sergeants' call, 12; dinner, 12:15 P. M.; fatigue, 1; drill by battalions, 4:15; guard mount, 5; parade, 5:30; supper, 6; tattoo, 9; call to quarters, 9:10; taps, 9:15.

The soldiers manage to amuse themselves in many ways. The colored troops are well supplied with guitars and mandolins, and the vocalists of the regiments give very acceptable concerts, which would do credit to the best negro minstrels. As the prospect of being sent to the frontier came nearer there was less and less time for amusement, but the historic associations around them, the prospect for the longed-for fighting, the new scenes and martial spirit of mobilization made it interesting enough for the troops, who are tired of the humdrum life of their reservations; and when the volunteer troops shall have occupied the camp, it is likely that their attention will be largely devoted to the necessary drills, for there is plenty of hard work at Camp Thomas, and drills are the order of the day, morning, noon and night. There are company and regimental drills, and field maneuvers are to be held in which the combined forces will participate. In these the actual conditions of war will obtain, with the exception of ball cartridges, and the soldiers will get a taste of real service on a large scale as far as fighting under the new tactics goes. One of the prettiest sights is the cavalry drill, and some of the many commands are at it nearly all the time, and one of our engravings shows the second division cavalry en route for the drill field. This cavalry drill is one of the features of interest to visitors, and they stand for hours watching the evolutions of the men and horses as they break into squadrons, wheel, charge, re-form, with perfect alignment and go thundering away with flashing sabers and piercing yells.

There are many indications that Camp Thomas is more than a temporary camp, and the chances are it will be maintained as a military training ground as long as occasion shall require. It was at first intended to

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concentrate nearly 60,000 of the National Guard at the camp, but the plans have changed several times since, but as we go to press it is said that 30,000 volunteers will be sent there immediately, and will be in a condition to strike Cuba after the expected naval battle.

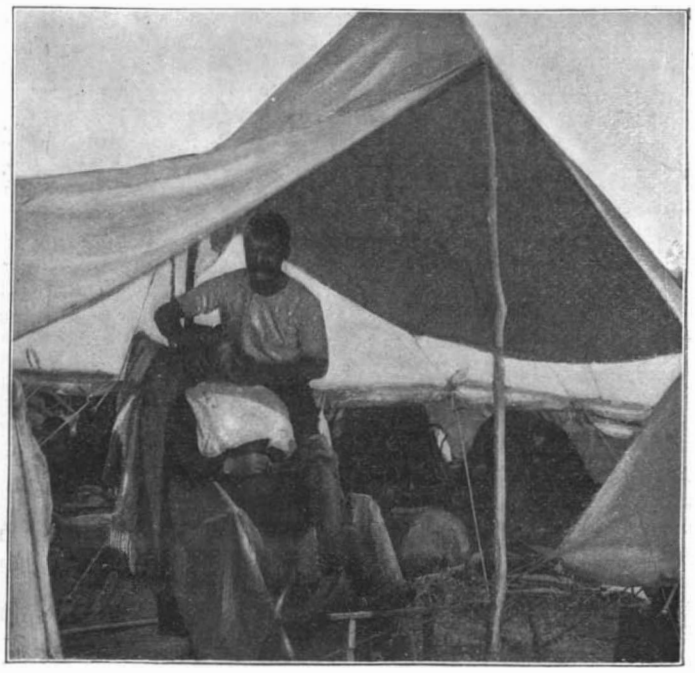
It has been decided to build a track on the Western for actual service. When orders were received to go to the front, the signal to strike tents was given just after reveille, and in the cold, gray light the canvas city fell to the ground. Tents, cooking utensils, rations, baggage and all impedimenta were quickly packed into the blue army wagons and six mules tugged each over the road, disappeared and grass would quickly grow again, were it not for the fact that the site will probably soon be occupied by regiments of volunteers.

Our engravings show the Ninth Infantry at Washington en route for the South, the camp of the Twelfth Infantry, the Second Division Cavalry en route for the

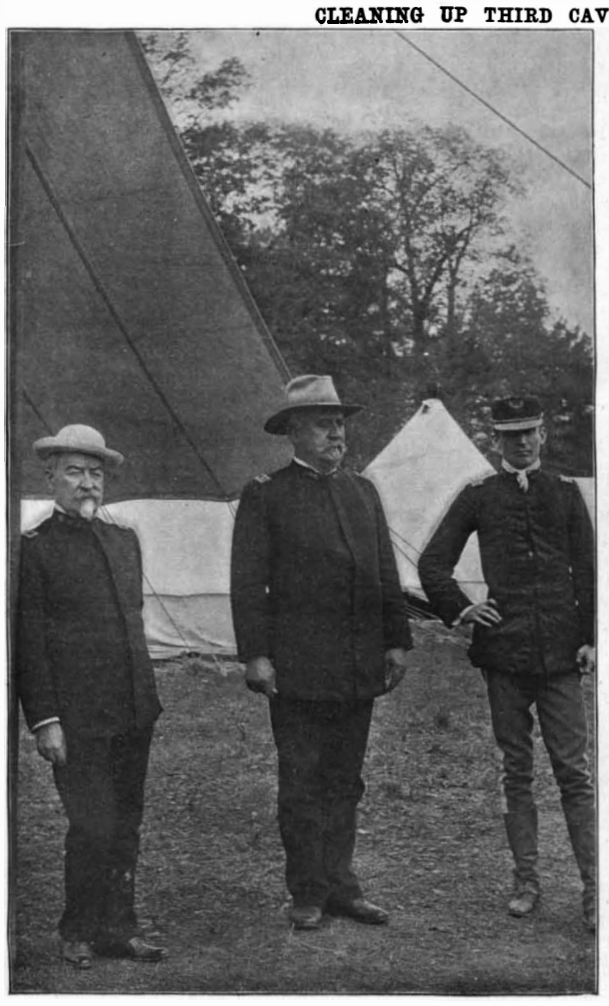
CAMP OF TWELFTH INFANTRY.

SECOND DIVISION CAVALRY EN ROUTE FOR DRILL FIELD.

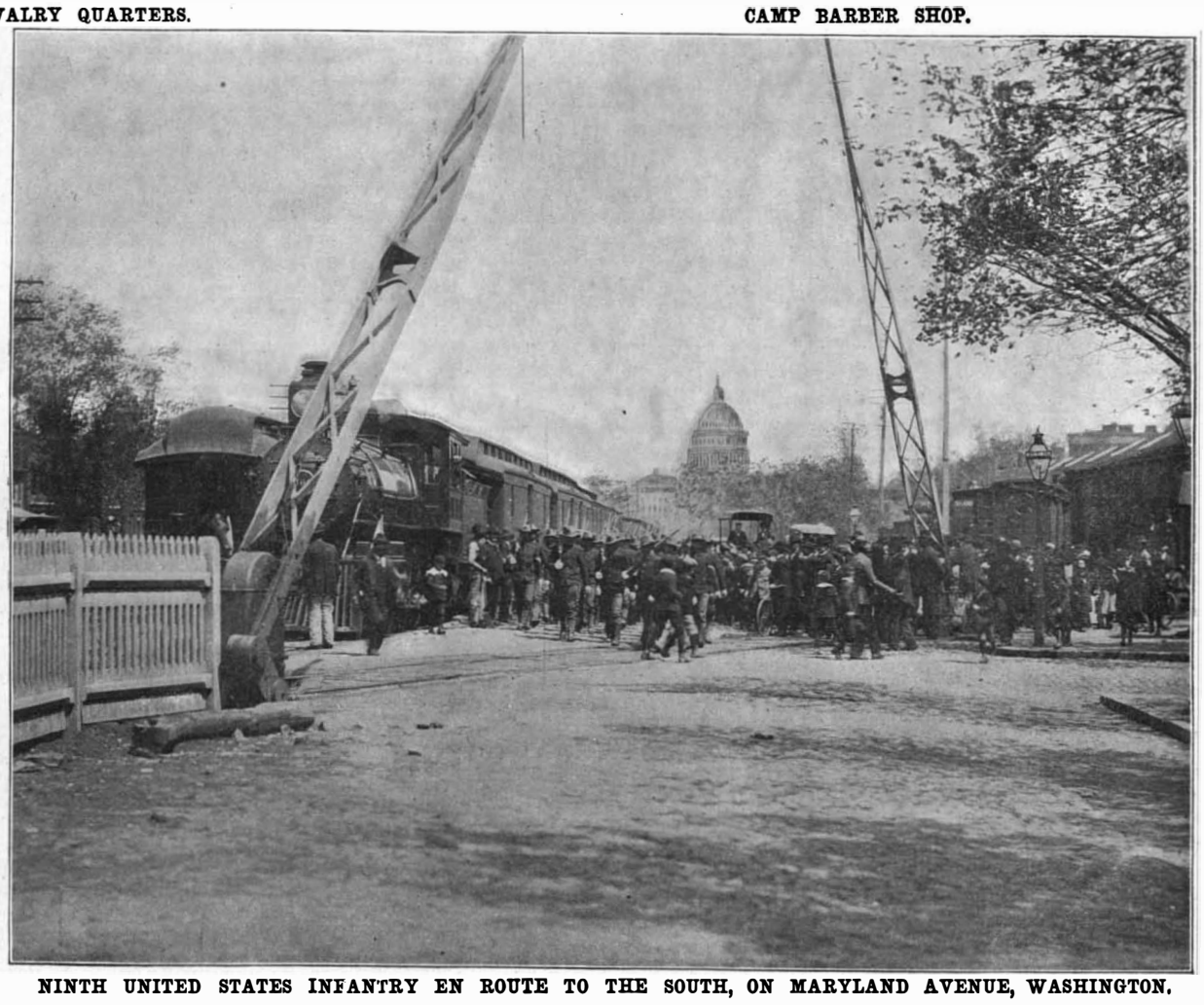
CLEANING UP THIRD CAVALRY QUARTERS.



CAMP BARBER SHOP.



MAJ.-GEN. BROOKE AT HIS HEADQUARTERS.
ADJ.-GEN. M. V. SHERIDAN. LIEUT. McKENNA.



NINTH UNITED STATES INFANTRY EN ROUTE TO THE SOUTH, ON MARYLAND AVENUE, WASHINGTON.

MOBILIZING THE UNITED STATES ARMY AT CHICKAMAUGA PARK.

and Atlantic road, at Ringgold, to Chickamauga, a distance of eight miles, for the quick transportation of troops. It is expected that it will take sixty days to build the track; so that it is presumed by some that the volunteer troops which are sent there are to be drilled for some time before they are sent away to the front now well worn, to Chickamauga Park station, where the wagons, still holding their cargoes, were rolled upon flat cars. The mules and horses were put into box cars and company after company were assigned to comfortable tourist cars. There remained behind only an empty, barren field, where the last traces of grass had drill field, "cleaning up quarters," Third Cavalry, a camp barber shop, and Major-General Brooke, who commanded the camp, at his headquarters with Adjutant-General M. V. Sheridan and Lieutenant McKenna. Our Chickamauga views are by M. M. Mudge, of Chattanooga.

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RECENTLY PATENTED INVENTIONS.

Agricultural.

GANG PLOW.—Frederick W. Gordon, Valley View, Tex. This invention comprises a frame, a plow disk carried by the frame and a wheel forward on the frame. Means are provided whereby the position of the wheel with reference to the frame may be varied. A guide wheel is placed rearward in the frame. The frame is connected with two rigidly joined beams, a spindle projecting rearward from each beam and a disk for each spindle. The disks are set at an angle to the frame and have novel adjusting devices.

Bicycles, Etc.

BICYCLE OR TRICYCLE SHOULDER ABUTMENT.—William F. Williams, London, England. The object of this invention is to provide a point of resistance for a rider's shoulders, so as to enable the muscles of the body to supplement the action of the legs. The abutment, moreover, insures an erect carriage and promotes chest development. The device comprises a post mounted on a bicycle, a socket pivoted to the post, a rack sliding in the socket, a pinion mounted on the socket and engaging the rack, a forked frame having a knuckle-joint connection with the rack and a shoulder support attached to each arm of the frame.

FLUSH JOINT FOR TUBULAR FRAMES.—Frederick C. Avery, Toledo, O. This flush joint consists of a receiving member having a continuous circular kerfed seat cut entirely through the cylindrical side of the tube at two opposite points, and having uncut bridge pieces at intermediate points with acute angular grooves in them; in connection with the tubular entering member having its ends beveled upon the inner side and inserted throughout its entire circumference into the circular kerfed seat of the receiving member for the purpose of rigidly connecting at various angles the tubular frames of bicycles, their handle bars, seat posts, etc.

BALL BEARING.—Frank Gustaveson, Wabasha, Minn. This ball-bearing comprises a hub having cups therein, each provided with flange or collar extending inwardly from the raceway and cupped or decreased in diameter at its inner end, whereby an oil-receiving cup is formed, an axle having cones thereon co-operating with the cups to form ball raceways, balls between the cones and the raceways of the cup and a tube surrounding the axle with its ends entering the oil-receiving cup and constituting an oil reservoir.

Electrical.

ELECTRICAL FOOT GEAR.—José Gallegos, Guatemala, Guatemala. This novel foot gear is provided with a static electrical generator for frictional contact with the human body, consisting in a closely formed fabric composed of strands covered with glass beads, the beads lying close to one another and forming the surfaces of the fabric.

ELECTRICAL DENTAL ENGINE CONTROLLER.—James J. Coachman, Rio Janeiro, Brazil. The controller for which this patent was granted comprises a base, a pedal mounted to swing on the base, a series of contact strips on the bases, contact points carried by the pedal and engaging the strips, a resistance having connection with a contact on the pedal, a spring-yielding contact carried by the pedal and having connection with the pivot of the pedal, the pivot being in the electrical circuit, a pole-changing lever, solenoids for and operating the pole-changing lever, a circuit closer operated by the movements of the pole-changing lever, and another circuit-closing lever having pins extended upward through the base. This apparatus is designed to provide a simple means whereby small electric shunt-wound dental engine motors can be started, run forward or backward, and stopped instantly when so required.

Miscellaneous.

SHRAPNEL PROJECTILE.—Michel Darmancier, St. Chamond (Loire) France. This projectile is provided with a cavity, the walls of which are provided with longitudinally extending grooves, a tube running centrally through the cavity and having grooves in its outer surface, the lower end of the tube having a disk with a serrated periphery conforming to the grooves in the walls of the cavity and balls arranged within the cavity and lying in the grooves. A fuse holder is secured to one end of the projectile to close the cavity and has connection with the central tube. The invention is designed to insure the freedom of the projectile from premature deformation when normally discharged, excluding all agglomerant substances which are ordinarily employed in shrapnel projectiles.

WORK HOLDER.—Canly D. Eames, Worcester, Mass. This novel work holder comprises a bow and clamping devices depending from ends of the bow, and composed of spring loops forming clamps which are arranged at right angles to the bow and are open at their bent lower ends to permit the convenient insertion and removal of the work held stretched parallel to the bow proper. The device is designed to enable the operator to hold the fabric conveniently while sewing thereon and relieving the fingers of the hand holding the material, of the tiresome strain resulting from holding the material in position by hand.

NUT LOCK.—Charles J. McCue, La Veta, Col. A nut having grooves in opposite side edges at its inner face is provided with a fastening device comprising upper, lower and end members, the upper member being provided at its free end with a head to engage with an end face of the nut and a flange projected at right angles to pass over the top of the nut and engage with the end face of the nut, the flange thus serving as a fastening and also serving to indicate the member to be at the top of the nut. This nut lock is especially applicable to railway rails to be used in conjunction with the fish plates thereof. The lock is simple, can be quickly attached to any nut, and is designed to prevent the nut from being turned or moved by the traffic on the rail.

ACETYLENE GAS GENERATOR.—William McGraw, Mount Airy, O. This acetylene gas generator is provided with a casing in which a carbide container is located, having a series of cells. Water cells placed above the carbide cells are designed to discharge water therein, and communicate one with another. Means are provided for automatically governing the flow of water through the bottom opening of the cells, and a cylinder receives the gas, from which cylinder a burner pipe extends.

SAW SET.—Henry Neidhart, Brooklyn, N. Y. A saw-setting mechanism, comprising a pressure lever, is connected with a rock shaft, an arm being mounted on the shaft. A block is adjustable on the arm, a rod is adjustable through the block and a spring connection is located between the arm and block. Connections between the rock shaft and pressure lever are provided whereby the shaft will be rocked by a downward movement of the lever.

LIFE-BOAT.—James Mitchell, Sr., Arrow River, Canada. This boat comprises a hollow inclosed figure having a rope guideway at each end of the boat, communicating with the interior and adapted to receive a suspending rope, and means for automatically closing the rope guideways upon the removal of the rope. The suspending rope having been severed from the interior, the boat drops into the water on an even keel.

AIR GUN.—Elmer E. Bailey and Thomas A. Monk, Philadelphia, Pa. The magazine of this air gun is provided with an apertured disk at its front end, and the lock frame has a socket in its front extension. The firing tube is held at its front end in the disk and is provided with an enlarged head which fits in the socket. The head is made of hardened metal and its longitudinal passage is tapered, there being an angular shoulder formed at the inner end of the passage, which shoulder abuts on the firing tube and is of less diameter than the latter. This serves to reduce the shot used in the gun to a uniform size, so that they may properly fit the tube. An air-jet tube, a piston attached thereto, a piston rod, air cylinder and means for reciprocating the piston are also provided and combined in a novel manner.

HORSESHOE.—Neil L. Olson, Butte, Mont. This horseshoe, having thickened toe and heel portions and sockets therein, the socket or sockets in the toe portion ranging at an incline approaching an angle of 45 degrees to the plane of the shoe and provided at the inner ends of the sockets with seats for the calk keys, the calks having stems fitted to the shoe sockets and grooved and notched heads, and the keys having at their inner ends portions to engage the seats of the shoes and at their outer ends heads to enter the notches or sockets in the calks.

PLACKET PROTECTOR AND SKIRT SUPPORTER.—W. H. Carr and J. G. Wolf, New York City. Two members pivoted together comprise this placket protector and skirt supporter. The lower ends of the two members overlie each other and the upper ends have an interlocking engagement. To the upper end of one of the members a hook is adjustably secured. This device is designed to hold the placket opening of a dress closed and may also be utilized for supporting the dress skirt from the belt.

PNEUMATIC STACKER.—William H. Cook, Winfred, South Dakota. This pneumatic straw stacker is designed to take the straw from an endless elevator apron and to carry it along by the force of a blast of air to the desired point. The device comprises an endless elevator apron, a pneumatic pipe conveyer and a rotary fan delivering a current of air into the same, the fan having a ratchet clutch connection with its driving mechanism to permit the fan to continue its revolution unimpeded by the retardation of the driving mechanism.

GAGE ADJUSTING TIE PLATE.—Alex. B. B. Harris, Bristol, Tenn. In this invention various features of construction and arrangement of plates and spikes are designed to permit railroad rails to be adjusted laterally to correct any deviation from the proper and standard gage. The plate itself is of an improved construction. The rail and tie fastening comprises a tie plate having on its under side integral spike tongues and two expanding plug spikes, one having a straight shank and the other having a recess just beneath its head that reduces the thickness of the spike, the two spikes being arranged to go on opposite sides of the rail and to be interchangeable to correct the gage of the rail.

BOTTLE.—William A. Fries, Sr., Brooklyn, N. Y. This non-refillable bottle has a neck portion provided with an interior annular shoulder and an interior annular channel, a valve casing consisting of a lower tubular portion having a flange at its upper end and a valve seat, an upper portion provided with outlet ports and having lugs, the lower ends of which are inclined outward and downward to engage against the bottom walls of inclined notches formed in the top of the flange of the tubular portion, a ball valve in the casing adapted to engage in the valve seat, a cork bushing surrounding the tubular portion of the valve casing, the bushing being somewhat longer than the tubular portion and resting on a shoulder formed in the neck of the bottle, and locking means carried by the upper portion of the valve casing and adapted to engage in the annular channel in the neck of the bottle.

DUMPING VEHICLE.—John M. Goodwin, New York City. This dumping vehicle comprises valves in its bottom portion, a shaft upon which the valves are mounted to swing, struts on the lower sides of the valves, rotary shafts below the valves, detents on the shafts to engage with the struts and support the valves, levers loosely mounted on the shafts, means for locking the levers to the shafts, a vertically movable piston, a cylinder in which the piston operates, and a connection between the piston and the levers. A novel mechanism is provided for operating the valves of the vehicle.

TOOL FOR BORING TAPERING HOLES.—Irving W. Mason, Aberdeen, Wash. This drilling tool for boring tapering holes comprises a tapering center or spindle adapted to be held in a fixed position and formed with a screw rod, a bit having a body into which the rod screws, the bit being also provided with flexible arms, and cutters held on the free ends of the arms and engaging the tapering surface of the spindle.

GAME APPARATUS.—Henry T. Pycroft, Parnell, New Zealand. A game board having vertical, horizontal and diagonal lines intersecting one another, the diagonal lines crossing one another at right angles in the squares formed by the vertical and horizontal lines, is provided with marks having characters indicating the starting points for the men or counters, being produced on sundry of the points of intersection of the lines at each end of the board. Marks also serve to regulate the movement of the men or counters being produced on other points of intersection of the lines.

CURTAIN TASSEL ATTACHMENT.—Henry T. Pycroft, Auckland, New Zealand. A shade attachment is provided with a series of rings secured to one another to form a globular structure. A hook is attached to one of the rings and a plate is bent over one of the rings at a point removed from the hook, the plate having two portions lying against each other, the portions being perforated to receive a cord. The device is designed to prevent the shade cord and tassel from being accidentally wound around the roller by the action of the spring.

EVAPORATING APPARATUS.—Walter H. Underwood, Hutchinson, Kansas. The invention for which this patent was granted consists principally of a feed pipe discharging brine or like liquids over the dome of the fire box so that the discharged brine washes the salt off as it falls on the dome before it can burn thereon. The invention further consists of a fire box, an evaporating chamber around the fire box, a heating chamber around the evaporating chamber and curved flues in the evaporating chamber connecting the fire box with the heating chamber to increase the heating surface of the flues, and thus permitting expansion and contraction of the same and dislodging the salts which may have accumulated on the flues.

HOLDER FOR HATS.—Franz Wagenblast, New York City. This holder for hats comprises a bar or plate having on its front face lugs at one end and a hook at the other end. A hat ring is provided with oppositely projecting arms, one of which is hinged to the lugs of the bar or plate, the other being provided with an offset. A lock locks the offset arm of the ring to the hook of the bar or plate. With this device the hat can be hung up and securely locked in place so as to prevent its removal by unauthorized persons. The device is especially serviceable in public places.

MOP WRINGER.—Herrmann A. Wolf, New Haven, Conn. A body portion open at the front is provided with supporting ledges, upon which ledges a perforated mop receptacle is arranged to have bearing. A stop is carried by the mop receptacle, which stop extends over the bottom of the receptacle and is adapted for engagement with a mop head. This mop wringer is designed to be readily applied to a bucket, and by means of which the mop may be quickly and easily compressed so as to force all or most of the water from the mop.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

GLASS BLOWING AND WORKING. For Amateurs, Experimentalists and Technicians. Based upon a Course of Lecture Demonstrations given under the Auspices of the Technical Education Committee of the Middlesex County Council. With Colored Frontispiece and Numerous Illustrations. By Thomas Bolas. New York: Truslove & Camba. Pp. 212. Price $1.

Anything from the pen of Thomas Bolas is usually not only interesting but eminently practical, and we have no hesitation in saying this is the best book on glass blowing for amateurs that has ever come under our notice. By following the directions and using proper materials any amateur ought to be able in a short time to make such glass apparatus as he needs, even though he does not become an expert glass blower. The illustrations, which number 104, while not particularly well executed, are clear and give the amateur an excellent idea of how the work is done. At the end is a bibliography of glass which is of great interest, and while probably not complete, still gives the titles which are most easily acceptable.

MODEL ENGINES AND SMALL BOATS. New Methods of Engine and Boiler Making. With a Chapter on Elementary Ship Design and Construction. By Nevil Monroe Hopkins. Fifty illustrations. New York: D. Van Nostrand Company. 1898. Pp. 74. Price $1.25.

This little book will be welcomed by all amateurs who are fond of using tools. The directions are very practical and the illustrations are from clear working drawings. The book describes the building of small engines and boilers, including water tube boilers and the building of small model ships. We recommend this work to the amateur. Mr. Hopkins will be remembered as the author of an interesting article published in the SCIENTIFIC AMERICAN for September 11, 1897, on "How to Build a Small Alternating Current Dynamo Without Castings."

WHAT IS FIRE PROTECTION? A Study. By Edwin O. Sachs. Second edition. Pp. 37.

THEATER EXITS. A Paper by Alfred Darbyshire. With a Description and Plan of Sir Henry Irving's "Safety Theater." London. 1898. Pp. 13.

These are publications of the British Fire Precaution Committee, and are two of the first pamphlets in the series. Several other important papers are promised.

TRANSACTIONS OF THE ASTRONOMICAL AND PHYSICAL SOCIETY OF TORONTO. For the year 1897. Including eighth annual report. Toronto. 1898. Pp. 154. Price $1.

COMMUNICATION ON CIGARETTES

FROM

PROF. J. W. MALLET, OF THE UNIVERSITY OF VIRGINIA.

TO THE EDITOR OF THE SCIENTIFIC AMERICAN:

DEAR SIR:

The recent publication in your journal of the results of an examination by me of some brands of cigarettes in general use has led to my receiving a number of letters of inquiry, some in reference to the mode of making the examination, some in regard to the names of the brands examined, and others expressing some surprise at the results reported and seeking confirmation of the statements which have been published.

The examination in question looked simply to ascertaining whether the cigarettes tested did or did not contain any traces of foreign adulterating materials alleged to be sometimes introduced by the manufacturers.

The methods of testing were simple, well approved and easily applied, and the results were clear and positive. In such matters a competent chemist reaches conclusions which admit of no doubt or uncertainty, and the results reported are not opinions, but scientifically ascertained facts.

It is the more remarkable that there should be any hesitation in accepting these conclusions, and that any credit should be given to the reckless assertion sometimes made as to the general adulteration of cigarettes with opium, etc., since numerous other analyses have before now been made by other trustworthy chemists, and in all cases the same general result has been recorded I know of no scientific evidence to the contrary.

It is, moreover, apparent to any unprejudiced person, competent to consider the facts, that such adulterations as have been alleged could only be made out of sheer perversity and would be in plain contravention of the business interests of the manufacturers.

Ignorance of easily ascertainable scientific facts is, however, common enough, as is often illustrated by the brown, oily material formed in the smoking of tobacco being pointed out as nicotine; though in reality this is merely the *tar* produced by the action of heat on the woody fiber of the leaf.

Nicotine when pure is a colorless fluid of somewhat oily consistence and strong, peculiar, penetrating odor, but it darkens on exposure to air and light, becoming first yellow and then brown, so that it *looks*, in this darkened condition, something like the tarry matter which soils a smoker's fingers or a handkerchief through which tobacco smoke is exhaled, or is often noticed as deposited in the stem of a pipe. This tarry deposit has nothing essential in common with nicotine, and contains but traces of this alkaloid, when any at all. A part, but only a small part (about one-seventh in the experiments of Melsens), of the real nicotine of tobacco is volatilized without decomposition; the remainder is burned and destroyed in the process of smoking.

The sensational statements occasionally made in regard to arsenic, copper, etc., as present in the paper wrappers would be at once seen to be grossly improbable if it were but remembered that the wrapper of a single cigarette weighs little more than half a grain, and that in such a minute quantity of thin, delicate, white paper there could be introduced but infinitesimal amounts of such foreign adulterants without their presence becoming perceptible to common observation by the senses, aside from the positive scientific evidence that they are *not* present.

The simple facts are, that such cigarettes as I have examined, representing a large part of those in general use throughout the United States, are made from pure, light-yellow tobacco of the high grade produced on certain special soils, prominently in certain of the southern counties of Virginia and the adjacent portion of North Carolina, with wrappers of the best quality of harmless vegetable fiber paper, and are entirely free from the adulterants which it has been asserted are present, with no evidence in favor of such assertion, and in absolute contradiction of the scientific evidence actually available.

I am, sir,

Your obedient servant,

(Signed) J. W. MALLET,

Charlotteville, Va.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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A good mechanic—photographer, designer, engineer—wants situation. "H," Box 976, Meriden, Conn.

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TO INVENTORS.

An experience of fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7428) I. E. B. asks: How many cubic feet of gas will an apparatus as mentioned in article generate in twenty-four hours and how long will the charge last? Taking such an apparatus as mentioned in article as the base, how large an apparatus would it take to supply ten lights, such as are used in houses, burning eight hours a day? A. The charge for the Adams apparatus as described is from one to two pounds. Each pound pure carbide generates 5¾ cubic feet of gas, or 11½ cubic feet for a full charge of 2 pounds. It is not a continuous generator. When the 2 pounds of carbide is exhausted the charge must be renewed. Care must be taken to keep fire away from the apparatus while it is open or being charged. The number of lights the apparatus will supply will depend upon the size of the burners; 10 one foot burners for 8 hours will require 80 cubic feet of gas, which will call for an apparatus seven times larger in capacity than the one illustrated in SCIENTIFIC AMERICAN. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1057, 1149, 1150, for illustrated articles, 10 cents each mailed.

(7429) C. P. writes: A tank of oxygen was passing down the street. It was of usual size, 4 feet by 14 inches, the pressure about 220 pounds to the square inch, when it exploded, blowing the bottom off and sending the tank through walls, crashing into living apartments. The concussion was so terrible it broke all the windows for half a block, blowing the men in charge into the air, they escaping with shattered clothing and slight injuries. I have hitherto regarded oxygen as harmless and non-explosive. Why this should have exploded after standing three or four days, and after the pressure of the pump and after a little having been used out of it, I do not understand. Have heard that if grease got inside of the tank that it would combine with the oxygen and form a spontaneous combustible gas, but in all my experience I have never met with an accident of this kind and I have been in this business, viz., filling and supplying oxygen and hydrogen tanks of gas, and do not know that there is any truth in the grease theory. A. The bottom of the oxygen tank was blown out by too great a pressure. The oxygen cylinders deteriorate much faster than the hydrogen, since the oxygen rusts the iron or steel and hydrogen does not. Probably this tank was weaker than was supposed, and the jar of carrying it was sufficient to produce the rupture. We do not think any theory of spontaneous combustion necessary. The cylinders should be tested frequently, nor should oxygen ever be put into a cylinder without drying the gas.

(7430) J. C. asks: What is the cause of a bottle of ale or porter freezing in winter when it is very cold, when you draw the cork? What I mean is, on a cold day if you take a bottle of ale, before you draw the cork, it is liquid, and if you take it into a warm room and draw the cork, it immediately freezes solid. A. The sudden freezing of water (ale is not necessary; it is the water in the ale which freezes) under these circumstances is due to cooling it considerably below the freezing point, while it stands quiet. If then it receives a sudden jar, it changes to ice almost instantly, and the temperature of the mass rises to the freezing point. Water has been cooled to 4° Fah. below zero without freezing. It is ready to freeze, but seems unable to begin to freeze. A bit of ice, or any other solid, dropped into the water, will start the particles, and they then jump into the solid form with great rapidity. It is a very pretty experiment.

(7431) C. E. asks: Can the core of an armature be made of aluminum, also the axle of an armature? If not, why? Can you give me any information regarding how light the armature of a ½ horse power motor can be made? A. Iron is the only substance of which the core of an armature can be made, since it alone can allow the magnetic lines to flow through it with sufficient ease. The shaft may be made of aluminum, for here strength is the only consideration, but it is not very good material for wear. We do not know what limit of weight has been reached in ½ horse power motors.

(7432) G. A. B. asks: What is a formula for preparing paper for use in receiving a telegraphic message by the chemical process? Or what kind of paper is best to use, and what is the best method of treating it chemically, so that an electric current will pass through it and record on it the message? A. Chemically prepared paper for autographic and automatic telegraphy is prepared by soaking it in either of the following solutions: Nitrate of ammonia, 2 pounds; ferricyanide of potassium, ½ ounce; gum tragacanth, 2 ounces; glycerine, 2 ounces; water, ½ gallon. Or, iodide of potassium, ¼ pound; bromide of potassium, 1 pound; starch, ½ ounce; water, 2 quarts; use any tough unsized paper.

(7433) J. J. R. asks: 1. How can I temper steel for horseshoe magnets, bar magnets and compass needles? A. To temper steel for a magnet, heat the ends of the steel to a red heat and plunge it endwise into cold water. 2. How to give the compass needle the dark blue color at one pole? How are the soft iron armatures of sounders blued? A. A simple method for bluing a small article is to varnish it with a thin shellac which has been colored with Prussian blue. It is usually done by heating, but this requires some experience and skill. 3. How is hair removed from the body by electricity? A. To remove hair by electricity apply to a skillful physician. The method of doing it is given in "Medical and Surgical Electricity," Beard and Rockwell. Price $5.50 by mail. 4. Where is telegraphing by electricity without wires treated of? A. For telegraphing without wires, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 790, 955, 995, 1131, and SCIENTIFIC AMERICAN, vol. 78, No. 14, 10 cents each.

(7434) T. H. writes: I am using a coil 18 inches long, 2 inches bore, of No. 23 insulated wire, 10 plies; the purpose is to draw an iron object of considerable weight into the coil, requiring a heavy current, but the heating of the coil stands in the way of the experiment. Is there any way of preventing this heating? A. In using a coil as a "sucking coil," the effect depends upon the number of amperes of the current and the number of turns of wire on the coil. The magnetizing power is the product of these two quantities. You are using rather a small number of turns of wire. You would do better to wind twice as many feet of wire on your coil, which will cut the current down and thus reduce the heating effect, while it leaves the magnetic effect the same as before. There is no need to use a coarser wire.

(7435) F. L. B. writes: In SCIENTIFIC AMERICAN of April 9, 1898, is a "Simple Mirror Galvanometer," by Mr. James F. Hobart. Can you tell me where I can find a more minute description of this instrument, that is about the connection of coil, what use is the lamp, how far is lamp from scale, hand glass from coil in chimney, what width and length and thickness is coil, what is the use of two needles, how long does the scale have to be, and does the yard stick (if yard stick is used) have to be reruled or divided in any other way other than what it is? A. The minor details of the construction of the mirror galvanometer are such as are common to all such instruments, and hence are not given in our paper. We do not know any description giving full details. It would be very lengthy. We answer your questions. The account tells you to connect the coils in series, that is so that the electricity will go from one on through the other in the same direction, as, for example, with the hands of a clock. The lamp is to furnish a beam of light through the hole in the screen, is reflected from the mirror of the galvanometer back to the scale, where it will show as a bright spot and will move to and fro as the needles of the galvanometer swing under the power of the current. The lamp is only a few inches from the scale; the hand glass is moved to and from till the spot of light on the scale is bright and sharp. The distance of the glass from coil depends on the magnifying power of the glass and must be found by trial. The core of coils might well be 2 to 3 inches long and 1 inch wide. The size of coils depends on the amount of wire used in them. Two needles placed with opposite poles as shown are more sensitive than one would be. The scale may be about 20 inches long, and may be used just as it is ruled, or a strip of paper may be ruled with any equal scale divisions, no matter what. The dates of the copies of SCIENTIFIC AMERICAN you requested are March 17, 1888, and August 31, 1889. We can supply all back numbers of the SCIENTIFIC AMERICAN for four years back, and most of the numbers for ten years back, at 8 cents each. We always have all back numbers of the SUPPLEMENT on hand, price 10 cents each.

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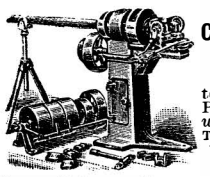

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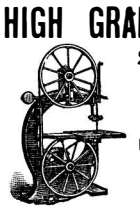

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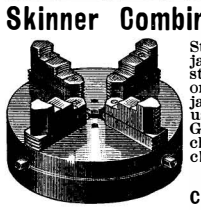

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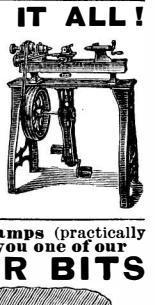

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The great desire during the present crisis for accurate information concerning the United States Navy has led to the preparation of a short treatise on the Navy, which has just been published under the above title. Every effort has been made by the publishers to treat the subject in such a manner that it may be readily understood by the reader unversed in naval affairs, and at the same time render the publication a permanent book of reference.

This issue takes the place of the regular number of the Supplement for April 30th, and consists of forty pages.

The number opens with a historical sketch of the birth and growth of the new Navy from 1883 to 1898, in which the programme of shipbuilding authorized in each year is given, together with the classes of ships which it called for.

This is followed by an article which explains the different types of vessels into which a modern navy is divided, and shows, by the assistance of diagrams, the manner in which the various types of vessels are classified. This article will greatly assist the reader in understanding the detailed illustrations and descriptions of each ship which make up the bulk of the issue.

The ships are grouped according to their type, as classified below. A comparison is drawn between different vessels of the same type, and the improvement of each ship on its predecessor is pointed out.

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Under the cut of each ship is a full table of her dimensions, armor, guns, speed, etc., and this is supplemented by tables at the end of the work, giving complete tables of the whole fleet.

The illustrations number about 90, and include handsome half-tone views and wood-cuts of all of the vessels above mentioned. Other pictures show in great detail the guns, gun-turrets, torpedoes, steering apparatus, conning towers, and many interior and sectional views of other parts of these warships. The whole forms a most complete and fully illustrated periodical.

In addition to the above is included a reliable map in colors, showing the island of Cuba and the West Indies.

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(Continued on page 335)

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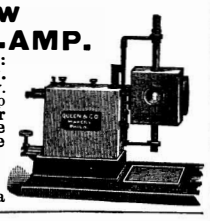

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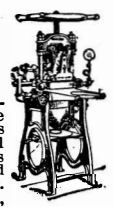

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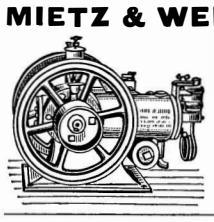

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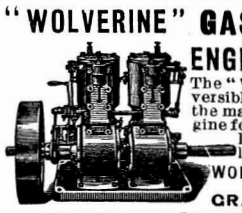

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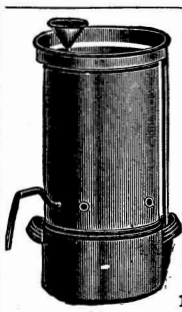

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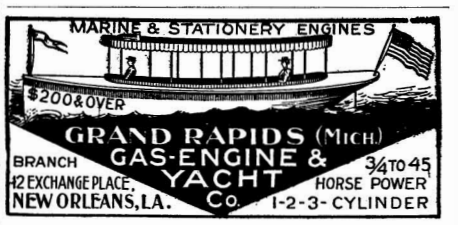

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